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NOTES FOR THE MONTH.

LIEUT.-COL. The Right Hon. Sir Arthur Griffith-Boscawen, M.P., has been appointed Minister of Agriculture and Fisheries in succession to Lord Lee of Fareham, who has been appointed First Lord of the Admiralty.

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FULL publicity has been given to the reasons why it is considered inadvisable to introduce store cattle into this country,

Store Cattle : but in view of the fact that the demand is
The Case Against still being urged in certain quarters,
Imports. recapitulation of the case may be timely.

In the first place it may be mentioned that the leading Agricultural Associations of whatever kind are strictly opposed to the import of "stores," and their opposition is based on sound knowledge of the case.

It should have been proved to the satisfaction of all concerned that there is in the policy of the Ministry no criticism, expressed or implied, of Canada's store cattle. Canada is not mentioned in the Act of 1896 upon which the existing prohibition is based; the healthy record of the Canadian herds is well known. In England, Scotland and Wales nearly two and a-half million beasts are slaughtered every year, and experts have calculated that Canada's possible contribution could not add four per cent. to this total, while if Canadian "stores" were admitted it would be difficult if not impossible, in spite of the attendant dangers, to close our ports to "stores" from other countries.

It is of vital importance that the British farmer should rear his calves, and to-day, for the first time since the War ended,

the balance between killing and rearing is about even. Clearly, if "stores" were admitted, the farmer's incentive to rear would be checked. Calves would go to the butcher in ever increasing numbers and the result would be that, not only the Nation's home-grown meat, but the national milk supply would gravely be endangered.

Further, there is no reason to believe that imported stores would be cheap. Shipping companies are unable to quote freight rates and the old cattle-fittings on certain ships, removed during the War, have never been restored. The price of home killed beef would not necessarily be reduced to the consumer by the import of "stores," for it is ruled by the price of foreign beef, and no farmer can increase his "stores" beyond the capacity of his yards, his grass and his arable areas. It cannot be pointed out too clearly that the farmer employs "stores" in order to make the best use of his grass or roots; the increase in the amount of meat that would result from a greater abundance of "stores" would not be great, because the number a farmer can feed is limited by the grass or roots he has been able to grow.

It is clear from the evidence before the Ministry, which has submitted the whole question to searching scrutiny, that the importation of foreign "stores," quite apart from the grave risks that would be incurred, would do nothing to help and much to discourage ninety-five per cent. of the farmers in these Islands, while failing to reduce the ultimate price of beef to the public. At the present moment no effective arguments have been adduced to destroy or even to impair the value of these considerations.

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Of late there have been certain criticisms of the policy adopted by the Ministry to stamp out Foot-and-Mouth Disease—

**Foot-and-Mouth
Disease: The
Ministry's Policy.**

a policy that has prevailed with gratifying success for more than twenty years. People have been asking why, in view of the cost of compensation, isolation and cure should not be attempted. Investigation of the facts and figures shows that compensation over twenty years has averaged £11,000 a year, and that if it be regarded as insurance on the country's live stock, which is valued at three hundred million pounds, the premium works out at 0.8d. per £100 per annum. There is no reason to doubt that, if it were possible to do so, every country in Europe would adopt the same policy as our own, but the extent of Continental outbreaks forbids. For

example, in four months of last year, there were more than one million cases of Foot-and-Mouth Disease in Spain, and the cost of the isolation and cure policy in connection with them may be estimated at well over five million pounds. The same huge figure is quoted by a Dutch authority as the cost of Foot-and-Mouth Disease to Holland in the two years 1919 and 1920, while in 1919 there were upwards of one hundred thousand cases in France, and, for the first six months of 1920, seventeen thousand cases in Germany.

Apart from the vast expenditure involved in a policy that is followed on the Continent only because territorial boundaries are purely artificial and incapable of arresting a disease which in all probability is air-borne, we have to consider the immense disadvantages suffered by the Continental farmer. He is liable at any moment to find not only his farm but his market closed, and transport of stock forbidden for a long period whether by road or rail. In this country, thanks to the drastic but effective measures in vogue, it has been possible to keep in check the most dangerous outbreaks and reduce restrictions to a minimum. On the rare occasions when the carelessness of some dealer or farmer has rendered the sanitary cordon temporarily ineffective, it has been possible to search out infected or contact beasts and destroy them before outbreaks can become widespread.

In the opinion of all practical men who have given this question careful consideration and have surveyed the working of the alternative system on the Continent, the policy of the Ministry has received ample justification from results, and, while it is admitted that Foot-and-Mouth Disease is curable, it must be acknowledged that any attempt to reverse the present practice would result in making the disease endemic in these Islands. This condition would have a very bad effect, not only upon our great export trade in pedigree stock, but upon the national supply of meat and milk and the normal conduct of the farmer's business.

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It will be remembered that a Bee Disease Bill, drafted in consultation with those actively interested in the industry, was

introduced into the House of Lords on the
The Bee 20th December last. Since then it has
Disease Bill. been decided that no new schemes
 involving expenditure of public money can be proceeded with.
 The Ministry has been compelled to inform bee-keepers that

the Bill will not be proceeded with at present. The Ministry has also had in contemplation the establishment of a Bee Advisory Committee, which was intended to represent every section of the industry. Its function would have been to advise the Ministry on all questions of apiculture, including the question of legislation in regard to Bee Diseases. It follows from the enforced postponement of legislation that this Committee cannot be established at present. In the circumstances, the Ministry has appealed to bee-keepers to take the necessary steps to organise themselves in order to arrive at an agreed opinion on measures that may be taken, without special legislation, for the protection and furtherance of the industry.

It is common knowledge that this country is spending something like £7,000 a day on imported honey, which is used, *inter alia*, for medicine, confectionery, the manufacture of blacking, and, unfortunately, to mix with home-produced honey for retail by unscrupulous dealers as a pure English product.

The possibilities of this country in the matter of honey production remain to be tested, and it is hoped that, now we have precise knowledge as to the action and nature of Isle of Wight Disease, it will be possible for British bee-keepers to develop their industry to a point at which dependence upon foreign and inferior material, purchased at a price the country can ill afford to pay, will become unnecessary.

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THE Stationery Office has now issued the Tenth Report of the Development Commissioners, and those who are interested in

The Tenth Report of the Development Commissioners. Agricultural Research will find in its pages an arresting record of scientific development. After dealing with the origin and purposes of the Fund and the methods of allocation

and administration, the Report considers the whole policy of research in Agriculture, and sets out in detail the work done at nearly a score of Research Institutes, beginning with Rothamsted and ending with Oxford. No deep study of this section is required to show that in all directions research is moving towards its goal and that the practice of farming is being quickened and revived by the devoted work of men and women who give all their energies to the solution of the special problems entrusted to their care.

The third section of this Report is an epitome of scientific research in agriculture and is of the happiest augury to the industry. Further chapters deal with local and special investigations in England, Wales, Scotland and Ireland, with the training of agricultural investigators, with Farm Institutes, with schemes for livestock improvement, with rural industries, the reclamation and draining of land, forestry, co-operation in agriculture, and agricultural development in the past and in the future. The last three chapters are devoted to Fishery Research, Inshore Fisheries, and the construction and improvement of harbours—matters with which the Fisheries Division of the Ministry is actively concerned.

The Report is a compendium of most varied information and no man engaged in any branch of agriculture can fail to derive advantage from its close perusal. Many of the facts dismissed in a few words are of absolutely illuminating quality. What can be more significant to the future of agriculture than the statement contained in this one sentence dealing with the work of the Plant Breeding Institute at Cambridge—"Already two varieties (of wheat) raised by the Institute have carried crops of twelve quarters per acre and over without becoming lodged, and there are indications that still better standing types can be obtained." When we consider that the average of production of wheat in this country is not more than four quarters to the acre and that the whole economic problem of the farm and the still larger problem of national food supply are dependent in no small measure upon the wheat return, it will be seen that there may be an opening here for a revolution in farming that will enable the country to reduce its dependency upon foreign sources of supply and the farmer to carry a large and well-paid staff with profit to himself. What this means to the re-population of rural England and to a proper adjustment between urban and rural areas may be left with safety to the dullest imagination.

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In the beginning of last month, Hemycok, in Devonshire, established a Calf Club, the first of its kind in this country.

The idea of the club comes from America, and its adoption in England is full of promise to the dairy industry. Under a well-considered scheme, the Club is composed entirely of the sons and daughters of local farmers and the ages of the twenty-one members vary from 14 to 18 years. Each member receives

a calf, for which the parents give a promissory note, and will have charge of it for a year, when all the calves will be examined by experts and prizes will be awarded to those members who obtain for their animals the highest number of points. If the rearers then wish to retain the calves they may do so, on redemption of the promissory notes. If they do not wish to keep them, the calves will be put up for auction and members will receive the difference between their original and present value. The calves, which are Shorthorns, have been selected from cows with good milk records, from 600 to 1,000 gallons annually.

A great stimulus has been given to the movement by the publicity it has received. The youthful members and their calves were photographed in the market place and these photographs have been very widely circulated through the Press. At an inaugural lunch, over which the youthful Chairman of the Calf Club presided, Mr. C. Carew, Member of Parliament for the Tiverton Division, expressed his pride in being the first M.P. in the British Isles to have the opportunity of attending such a function. It was pointed out in subsequent speeches that the whole object of the Club was to improve milk production, both in quantity and quality, and that Hemyock had not only established its claim to a place on the map, but had inaugurated in England a movement that would in all probability be followed throughout Great Britain, with great advantage to the general public and the dairying industry. In connection with the work of the Club, Mr. J. Mackintosh, of the Research Institute in Dairying, University College, Reading, delivered a lecture to the members on the proper methods of calf-rearing, pointing out the importance of light, airy and well-ventilated pens, dry floors, preferably of hard earth, cleanliness of the food supplied, and regularity in feeding. It is understood that the United Dairies, Limited, are associated with, and taking an active interest in this movement. In the United States of America, the policy of interesting children in live stock has been pursued successfully for a considerable time, and there are throughout the States many Agricultural Clubs entirely under the control of school boys and school girls. The idea is one that deserves encouragement, and it is safe to say that in the work just undertaken in Devonshire we have the beginning of a movement likely to enjoy a widespread development.

HOME-GROWN WHEAT PRICES.

THE Prime Minister received a Deputation from the National Farmers' Union, on the 16th February, in regard to the price to be paid for home-grown wheat of the 1920 crop.

The Deputation consisted of Mr. R. R. Robbins, C.B.E., J.P. (President, National Farmers' Union); Mr. J. Donaldson (Vice-President, National Farmers' Union); Mr. E. W. K. Slade, C.C. (Chairman, Cereals, Livestock and Wool Committee); Mr. E. G. H. Maddy, J.P., C.C. (Vice-Chairman, Cereals, Livestock and Wool Committee); Mr. H. Overman, C.B.E. (Representing Norfolk); Mr. W. Hasler, J.P. (Representing Essex); and Mr. A. D. Allen, O.B.E. (General Secretary).

The Prime Minister was accompanied by the Rt. Hon. Sir Arthur Griffith-Boscawen, Lord Crawford, and Sir Wm. Mitchell Thomson.

The Prime Minister discussed the matter in detail with the Deputation and in the course of the proceedings made the following statement:—

“ I do not think there is very much between us except on a matter of adjustment of figures. I have consulted my colleagues since my attention was called to this controversy. I feel personally, apart from the fact of being involved in it as Prime Minister and Head of the Government, under an obligation here. I made personal appeals to the farmers of this country, and I have taken a personal interest in the matter. The farmers of the kingdom responded in a way which I think is very creditable to British agriculture. There were other ways in which they could have made more money with less trouble, where they might have dispensed with a good deal of the trouble they are having with labour, but they met the wishes of the Government patriotically, and I gave this pledge to them after consulting the Cabinet, in order to give them a sense of security. The pledge which I then gave, interpreted by Sir Arthur Griffith-Boscawen in his answer in the House of Commons, I stand by in the letter and in the spirit, and where there is legitimate doubt I am prepared—and I do so after consulting the Cabinet—to give the benefit of the doubt to the farmers, because it is of paramount importance that there should be no feeling in any section of the community that the British Government has broken faith with them. Therefore I say at once, that we stand by these pledges. That means, as I

understand, that the price that will be paid to the farmer in respect of wheat which he markets will be a price which is determined by the cost of milling wheat imported during the two preceding months."

With regard to the extent to which farmers were deprived of a free market, the Prime Minister observed that: "Until the market is restored to normal conditions, as long as you have the present relations between the millers and the Government, although there is de-control and you have got a free market, you are entitled to say that you are affected to a certain extent by the conditions which I indicate. We therefore do not propose to take advantage of the fact that we have de-controlled wheat on the 25th January. We shall stand by the pledge on the other assumption, but the transactions must be governed, of course, by the conditions laid down by me here. . . . I shall ask you, upon that basis, to meet the Ministry of Agriculture, the Ministry of Food and the Treasury, to thrash out exactly what, in figures, the working out of these conditions will mean. Do not let us have any further misunderstandings. If you do not arrive at an agreement, come back again and we will discuss it. All I can say to you now is that I am deeply concerned that there should be no sense among the farmers of the country that we have broken faith with them. As far as I am personally concerned, I regard it as a matter of personal honour. I give you my personal word, as well as my word as Head of the Government. . . . I feel deeply concerned that the farmers should not feel that they have been misled in the least. Here is another thing I want to say. I am not going to interpret these words in a technical sense, to give a purely legal interpretation to them. I want to give the interpretation to them that an ordinary plain man would give to them. After all, farmers are not lawyers. I should like to put myself in the position of a farmer reading these words, and say to myself, 'What would I understand, if I were a farmer, as to what guarantee I was getting?' . . .

"A bargain is a bargain, which means you cannot say, when it happens to be against you, 'That is not what I understood,' and on that you cannot say, 'Well, I think that is what it means,' because it happens to be in your favour. I only want to have an interpretation of it that plain, honest, straightforward men of business, not straining words and not quibbling about the meaning of words, would place upon it. By that the Government stand, and I am specially concerned to stand by it myself, and I mean to do it."

In accordance with the arrangement made by the Prime Minister, a Conference, attended by representatives of the Ministry of Agriculture and Fisheries, the Ministry of Food, the Wheat Commission, the Treasury and the National Farmers' Union, was held on Thursday, the 17th February, 1921.

A report of the proceedings is given below.

Sir Arthur Boscawen : Now, gentlemen, those of you who were present at the deputation at Downing Street yesterday remember that the Prime Minister made it perfectly clear that he intended that the pledge given in the first instance by himself, and afterwards by me, should be carried out in the spirit and that wherever there was a doubt, that the benefit of the doubt should be given to the farmers, because he did not think that you were persons who were in the habit of construing technical questions and Parliamentary or legal documents, and he wished, therefore, not to stand on any technicalities, but to carry out the promise in the sense in which it was generally understood. Well, that being so, he invited this Ministry to consult with the Wheat Commission and the Ministry of Food as to the best method of carrying out the undertakings he gave yesterday, and we have had two conferences, one yesterday evening and one this morning, and I will just indicate to you the conclusions we have arrived at, and will then ask for your views on them.

We take this position, that the promise was for a maximum price of 95s. provided that the c.i.f. cost of imported wheat was 95s. or above and so long as wheat was controlled. We hold that, technically, decontrol took place on the 25th January, but we are prepared to give you the benefit of the doubt, that is to say, inasmuch as there is still control of flour mills, we hold that, although technically there is decontrol, from the point of view of construing the pledge, there is no decontrol at the present, and we propose, therefore, that the farmer shall be entitled to get, so long as there is not decontrol, what was stated by me in the House of Commons, the average c.i.f. cost of wheat imported during the two previous months. Well now, the effect of that decision will be this—that as regards sales, so long as control still exists, the price will be announced based upon the two previous months' cost, and the millers will be instructed to pay the farmers for wheat of sound milling quality that figure, and for inferior wheat they will pay pro rata. Of course, we are only dealing with milling wheat, not chicken food or anything of

that sort. As regards sales that took place before, for instance, from the 6th November roughly up to the present time, where a less sum has been paid than 95s. (the maximum certainly operated at that time, because the price of imported wheat was above it) in those cases, where the seller has been paid, the millers will be instructed to recoup to the person from whom they bought wheat, the difference between the price actually paid and 95s. for wheat of sound milling quality, and in the case of inferior wheat that is still good enough for the mill, a pro rata difference.

Of course a difficulty arises there, which we quite realise, that a lot of the wheat was not sold direct to the miller, but was sold by the dealer, and there may have been several transactions. In these cases, all the miller can do will be to recoup the person from whom he bought wheat the difference, and it will be up to the National Farmers' Union to see that the proper sum is passed back to the actual producer. I understand that probably the National Farmers' Union would be able, in most cases, to arrange that. (The conference agreed that there would not be likely to be any difficulty on this point, although certain cases might possibly give trouble.)

Well now, there is one point I should like to mention. I have told you that the pledge was for a maximum of 95s. so long as control continued, and that we are prepared, for the purpose of carrying out the pledge, to accept your view that there is still control. If the pledge is to be interpreted literally, supposing decontrol did take place in the immediate future, which is not very likely, but still it might occur, say, on the 31st March, strictly speaking our pledge would be fulfilled because the conditions under which the guarantee was given would no longer exist, but it is certainly the intention of the Prime Minister, and, I think, of the Cabinet, that as the pledge was really understood to be a guarantee for the year, and as the date of decontrol is doubtful, that we should not boggle over it. We want the farmers to feel absolute confidence, and therefore we will to all intents and purposes see that this guarantee is given for the whole of the rest of the cereal year. (Hear, hear.) I suppose, strictly speaking, we should fix a date—say about the 18th August, but this is only a suggestion, it has not yet been fixed definitely.

Well now, gentlemen, that is in broad outline, the conclusion we have arrived at in order to carry out the statement and promise given by the Prime Minister yesterday, and I hope that the Farmers' Union will realise that the Prime Minister has

really met the position very fully indeed, and that he is prepared to go a long way beyond the literal interpretation of his original pledge. He has given you the benefit of the doubt in all cases, and I do hope that this will restore confidence. As you know we are very anxious to maintain as large an area under arable cultivation (wheat) as we can, and I hope you will do all you can to support us in our general policy.

Mr. Langford: I understood you to say that the miller would be instructed to make up the price to 95s. for good sound milling wheat, and pro rata for inferior wheat. Is it to be presumed that the miller only bought wheat of sound milling quality?

Sir Arthur Boscawen: Oh, no. It must be wheat of milling quality, but there are, of course, various grades.

Mr. Langford: I think it would be a very dangerous loophole. May I ask who is to decide whether the wheat was of sound milling quality or not?

Sir Arthur Boscawen: The miller.

The question was raised by a member of the conference as to whether a farmer delivering direct to the mill would be entitled to a 1s. extra, i.e., 96s., and this point was confirmed by Sir Arthur Boscawen.

Mr. Robbins, in reply to Sir Arthur Boscawen, said: We quite realise, Sir Arthur, that you have met us in a very generous and liberal spirit, and we do not want to appear grasping or dissatisfied, but one point occurs to me, and that is whether it would be possible to take any steps to increase the demand for home-grown wheat. So many of our people cannot find a sale. I wonder if you could do anything at all to relieve the situation?

After a short discussion on this point, it was pointed out to Mr. Robbins that the chief difficulty was the general fall in prices, but that everything possible would be done to assist the farmers in this connection, although it was difficult to see how anything very material could be done. Every inducement had been offered to the miller to purchase English wheat, but the supply was at the moment greatly in excess of the demand.

In reply to a question from a member of the National Farmers' Union, Sir Arthur Boscawen stated that the maximum price for February and March was known to be 95s.,

after which it was possible that it might fall, but due notice would be given of any alteration. He also stated that in the event of a large quantity of English wheat being offered to the millers, it was possible that they would only be able to absorb that of the best quality, and would be obliged to refuse the inferior grades, which in normal times would be used for milling purposes—this was an aspect of the question which would have to be faced. For this reason, although it was going far beyond the pledge given, it had been decided to extend the cereal year until the 13th August, and it was hoped that this extension over a longer period would relieve the pressure on the mills.

After some further discussion, it was decided that a memorandum should be drawn up, setting out the conclusions reached, which should be submitted to the National Farmers' Union in its draft state for observations.

The conference expressed its satisfaction at the decisions reached, and thanked Sir Arthur Boscawen for the manner in which the question had been handled.

The memorandum referred to above was considered at a Conference reported below between the Ministry of Food, the Wheat Commission, and representatives of farmers.

NOTE OF CONFERENCE HELD AT THE MINISTRY OF FOOD ON WEDNESDAY, 23RD FEBRUARY, 1921.

Present:—

The Rt. Hon. The Earl of Crawford and Balcarres, <i>Chairman</i>	}	Royal Commission on Wheat Supplies.
Sir George Saltmarsh, <i>Vice-Chairman</i>		
Mr. H. F. Paul		
Mr. A. E. Humphries		
Mr. W. P. Burton		
Mr. J. S. Bowles, <i>Secretary</i>	}	Flour Mills Control Committee.
Major S. R. Reynolds, <i>Technical Adviser, Flour Mills</i>		
Mr. W. Nash, <i>Secretary, Flour Mills Control Committee.</i>		
Mr. E. E. Beare, <i>Acting Assistant Secretary, Ministry of Food.</i>		
Mr. R. R. Robbins, <i>President, National Farmers' Union.</i>		

Mr. W. Haslar, *President, National Association of Corn and Agricultural Merchants.*

Mr. S. Armstrong, *President, Incorporated National Association of British and Irish Millers Ltd.*

Mr. G. S. Hall, *Secretary, Incorporated National Association of British and Irish Millers Ltd.*

AFTER discussion and amendment of a draft prepared by the Department, the following scheme was agreed for carrying out the promise given by the Prime Minister on the 16th February, with regard to an announcement made by him on the 11th March, 1920:—

Price of Home-grown Wheat—1920 Crop.

In order to give effect to decisions which have arisen out of representations recently made to the Government by the National Farmers' Union, it has been decided that in respect of past purchases, i.e., purchases between the 8th November, 1920, and the 5th March, 1921, both dates inclusive, farmers or merchants who sold home-grown wheat to millers financially controlled by the Flour Mills Control Committee shall be reimbursed:—

- (a) In respect of each purchase of home-grown wheat of sound milling quality, i.e., of fair average quality for the season fit for milling into flour for home consumption, the difference between the price paid by millers per quarter of 504 lb. and 95s. free on rail, or 96s. delivered into the mill;
- (b) In respect of each purchase of home-grown wheat of inferior quality or condition, the difference between the price actually paid and the value of the wheat *as compared with the value of wheat of sound milling quality* (namely 95s. f.o.r. or 96s. delivered into the mill).

The following procedure for giving effect to the above decisions has been agreed upon:—

1. The seller (whether farmer or merchant) will make his claim upon a form obtainable from (a) his miller, (b) the National Association of Millers, (c) the National Farmers' Union, (d) the National Association of Corn and Agricultural Merchants, or (e) in Ireland, the Department of Agriculture and Technical Instruction for Ireland.
2. The claim form when filled in by the seller will be submitted to the miller to whom the wheat was sold.
3. The miller will verify the claims by reference to his books, and, if satisfied, will sign the certificate printed on the claim form and return it to the seller.

4. The seller will transmit the certified claim to the Secretary, Flour Mills Control Committee, 100, Cromwell Road, London, S.W.7, for approval.

5. The claim will be retained by the Department, who will forward direct to the claimant a Receivable Order Cheque, the cashing of which in itself provides the necessary receipt.

With regard to purchases of home-grown wheat on and after the 7th March, 1921, millers will be instructed to pay 95s. per 504 lb. if purchased on rail, or 96s. if delivered by road to the mill, for home-grown wheat of sound milling quality, and corresponding prices for wheat of inferior quality or condition. As this will entail the use of more capital than is required for the purchase of home-grown wheat at prices bearing strict relation to the current prices of imported wheat in accordance with F.M.C.C. Circular No. 298, millers making purchases of home-grown wheat will be furnished on application to the Director of Finance with a remittance on account of a sum per 504 lb. on the total quantity purchased during the preceding week.

This sum will be the difference between 95s. per 504 lb. f.o.r. and the current selling price of imported wheats of similar or comparable quality. For this purpose, the c.i.f. selling price of Argentine wheat per 480 lb. as announced by the Royal Commission on Wheat Supplies from time to time shall be adopted as the value per 504 lb. of home-grown wheat at station, with the addition of 1s. per quarter if delivered by road to mill.

The price of 95s. per 504 lb. will continue so long as the average (c.i.f.) cost of imported wheat remains above the parity of that figure. This average will be the average of the c.i.f. cost of all milling wheat imported during the two preceding months, and of the actual and anticipated arrivals in the United Kingdom during the current month subject to an adjustment in respect of the lower percentage of flour of equal water content obtainable from home-grown wheat as compared with imported wheat. In the event of this price falling below 95s. prices will be revised by the Royal Commission on Wheat Supplies in accordance with the cost of imported wheat and announced monthly.

THE NEW FARMING LANDOWNER.

THE EARL OF SELBORNE, K.G., G.C.M.G.

THE agricultural landowner who let his land to a tenant farmer but did not farm any of it himself, and the tenant farmer who rented land from a landowner and farmed it but farmed no land of which he was himself the owner, have played a very important part in the history of agriculture and in the economic life of the nation during the past 200 years; but it is my belief that both classes are slowly passing away.

The partnership has been an odd one and much to the advantage of the tenant farmer. In good times he has been able to secure a fair commercial return for the capital he has invested in the industry, and, since annual tenancies replaced leases, he has been able to quit the business quickly when times have been bad. The landowner, on the other hand, in good and bad times alike has received a wholly uncommercial interest for the capital he has invested in the industry. In bad times he has been liable to have the cultivation of the land thrown on his hands without the experience or the equipment with which to cultivate it successfully, and, latterly at any rate, in good times he has been very chary about raising the rent. This comparison is the more remarkable when it is remembered that at least two-thirds of the capital employed in agriculture have been supplied by the landowner.

The cultivated land of England is not, as Socialists are fond of saying, the free gift of God any more than the coat that the Socialist wears is the free gift of God. The cultivated land, like the coat, has been manufactured by the use of the brains and the physical strength given by God. Any amount of land can be had in the centre of Africa for nothing to-day, because it is in its natural state and unmanufactured, or (to use the term which is applied to the manufacture of cultivable land) unreclaimed. Exactly the same process has taken place in England during the centuries since the Romans came here. With the exception of tracks of down or heath land England was one mass of forest, thicket, swamp, or bog, and, when a landowner to-day acquires an agricultural property either by inheritance or purchase, what he acquires is not the land in its natural state but the product of reclamation and the industrial equipment of the land. This equipment is also an

essential part of the process of manufacturing cultivable land because, even if the trees had been felled, and the roots and the underwood and the briars and brambles rooted up, and the swamps drained, the land would be of no use to the farmer unless it had been supplied with farm buildings, houses, cottages, fences, roads, and a proper supply of water. All this equipment as well as the reclamation itself has been supplied by the capital of the landowner. The capital the tenant farmer has supplied is that necessary for the wage fund and for the purchase of live and dead stock.

If anyone doubts the accuracy of my statement about the manufacture of English land he should pay a visit to the famous Experimental Station at Rothamsted. There he will find that 60 years ago a corner of a wheat field was enclosed and left alone, and it has never been touched by the hand of man since. That plot of ground has reverted to the natural state of England, brambles, briars, underwood and young forest trees, and Dr. Russell, the Director of the Experimental Station, has informed me that to clear that piece of land and make it once again fit for cultivation would cost more than the capital value of the land itself.

It may well be asked why the landowners were prepared to invest their money so unremuneratively in agricultural land. The only possible answer is, that the habit must date from the days when the possession of land brought a social status nothing else could bring, and real political power. It could not have been the mere desire to live in the country, or the wish for sport, because men have always been able to enjoy the amenities of country life and sport by the process of hire. Purchase was not essential for the purpose. Nowadays the possession of land brings with it no political power, and social status can be acquired by other means, and the custom of land ownership, which was dying hardly, has been shattered by the crushing weight of war taxation. Landowners who were not farming their own land have found that by selling that land they can double their income, partly by the increased yield of their new investment, and partly because they become released from those charges and outgoings which make the net return from the rent of agricultural land so much less to the owner than the gross return. This is the simple explanation of the reason why there have been such great sales in the last few years. The new, and hitherto unknown, feeling of insecurity thereby produced to the tenant farmer has been the

justification for what is called "the compensation for disturbance" section of the Agriculture Act just passed. These provisions, however, will certainly not tend to arrest the process of selling land. For the reasons I have given very few agricultural landowners will henceforth be able to afford or, if they can afford, will care any longer to own land which they do not farm themselves.

The future of English agriculture I believe rests with the men who, whether on a small, moderate, or large scale, farm the land which they themselves own, and I believe that in the long run that is a surer economic basis for agriculture than the unbusinesslike partnership which I have endeavoured to describe. The returns from good farming will enable the owner-occupier to do justice to his land both as owner and as occupier, and to receive a reasonable commercial return for his capital; but to do this the farming must be good farming. The whole standard of farming throughout England must be lifted on to a higher plane than that on which it stands to-day. Not only bad, but indifferent, farming must disappear. The owner-occupier must educate his son so that he will know how to manage and farm his land properly and get the most out of it. His life's work will bring him into closer contact than ever with the agricultural labourer, and he will more and more appreciate the fact that that labourer, always really a skilled man, must necessarily become more skilled owing to the increasing use of machinery, and he will understand that low wages are an economic blunder as well as a social misfortune. He must, however, as firmly as courteously exact a full, honest day's labour for those wages, or he will not be able to live or give employment to anyone. The existence of occupying ownerships of every size throughout the length and breadth of England alongside the corresponding tenancies, which will necessarily long persist, will provide the most capable of those labourers with exactly that ladder of possible advancement which they have so much needed.

But there will always be owner-occupiers who are not able to devote the whole of their own time to their land, and those men will require the assistance of managers or bailiffs. It was one of the tragedies of the bad times in the 'eighties and 'nineties of the last century that, when landowners had land thrown on their hands which they had themselves to farm, they did not know where to look for a competent manager or bailiff, and they did not know how to pay a competent man

when they had found him. It is absurd to expect a man who has never had a proper agricultural education successfully to farm 1,000 acres of land and be responsible for the return on £10,000 to £15,000 of capital, and still more absurd to expect a man who has had such an education, and is competent, to be satisfied only with a salary of £150 or £200 a year and a house. Our agricultural colleges have always been turning out competent men of this class, but they could not find employment in England and they had to go to the Dominions or elsewhere to find employment. Henceforth there will be an increasing demand for this class, and the demand will create the supply, and our universities and agricultural colleges are now better equipped than they ever were to create the supply. How should such a man when found be paid? He may quite properly be guaranteed a minimum salary of £150 or £200 a year and a house to commence with, or in the case of large farming operations a larger sum, but the real way to reward him and to get the best out of him is to give him a good percentage on the profits as proved by properly and independently audited annual accounts. The most satisfactory relationship can be established on this basis between the owner-occupier and his manager.

It will be seen from what I have written that I at any rate am full of hope for the future of agriculture for that class which I have called the owner-occupier, and which includes within itself the small free holder and intensive cultivator of 50 acres living in a cottage and the owner of 5,000 acres living in a country house.

But for a long time yet there will still be landowners who do not farm all their land and who still let land to tenant farmers. Their duty seems to me to be clear; as long as they retain their land they must make every effort to fulfil their part even in these times of crushing taxation, and keep the land so equipped industrially that they can reasonably insist on the tenant farmer doing his part. They must regard it as a national duty as well as a proper precaution for the interest of their family not to tolerate bad or indifferent farming. They will be entitled to use the Agriculture Act to assist them in carrying out this duty, and they will be entitled to claim a full economic rent for their land. To the good farmers they are bound to continue to show that cordial and intimate consideration which it is universally admitted the old type of landowner always showed to his tenants. And those who have struggled

so manfully to preserve their family home and who would regard it as so bitter an experience to be obliged to leave it, must continue to realise as their fathers did that the process of quitting home may be just as disagreeable to the old-established tenant farmer as to the owner. When the land has to be sold every effort should be made to sell it at its fair value, whether by private treaty or by auction, to the sitting tenant; but, if the land is sold by valuation and private treaty and not by auction, then the owner will be entitled to protect himself by inserting a clause in the conveyance reserving to himself for a term of years the option of repurchase at the price for which he has sold the farm in case the purchaser decides to part with the farm within that period.

THE IMPROVEMENT OF PEATY SOILS.

PART I.—THE TRUE PEATS.

E. J. RUSSELL, D.Sc., F.R.S.,

Director of the Rothamsted Experimental Station.

THERE are three types of peat soils in England, differing markedly from one another, and presenting entirely different possibilities of improvement. They are:—

- (1) Fen soils, found in the eastern counties: Cambridge, the Isle of Ely, Norfolk, Huntingdon, &c.
- (2) Low-lying peat soils, found in Lincolnshire and in the west, such as the Carr soils of Lincolnshire, Nottinghamshire, the peats of Chat Moss, near Manchester, and other Cheshire mosses.
- (3) High-lying peat, found in the west and north, e.g., Dartmoor, the Pennine chain and its outliers, Hambledon, &c.

The fen soils are distinguished by the fact that they are not strongly acid, often indeed not acid at all; they are very tractable and are practically all in cultivation. Drainage is the chief requisite; when this is done the land becomes very fertile. There is little now left for the improver to do, excepting after a disaster like the breaking of a bank by the Little Ouse in the Southery Fen, Feltwell, on 3rd January, 1918, when 20,000 acres were badly damaged. A few wastes still survive. One of these occurs in Wood Walton Fen, near Ramsay St. Mary's, Hunts. Part of the fen is deliberately kept as a sanctuary for wild life. The rest, however, is agricultural land, but as the lower part is liable to flood it has been left uncultivated and is now a dense thicket of birch and willow; some had been cleared by a previous tenant but was allowed to become derelict and covered with couch, and in places by rushes. The management of the land is now in the hands of Mr. A. Lancaster Smith, and his reclamation methods are described in *Country Life*.^{*} Briefly the method is to raise the banks so as to keep out flood water, to break up the land with tractors, and then to grow potatoes, buckwheat, &c. Fen soils benefit by additions of clay but not of sand; they do not as a rule respond to lime—though this particular district is an exception—the most striking effects are produced by superphosphate, but not by basic slag. Some of

^{*} *Country Life*, 7th September, 1917, p. 187, and 21st June, 1919, p. 766.

the fen soils—including this one—respond to potash and also to nitrate of soda and sulphate of ammonia; others do not, however, on the so-called clay fen in the western side of the region.

Any farmer in the fens having small derelict areas in his possession would be fully justified in reclamation. Some of the Cumberland peats seem to resemble the fen soils in that they do not markedly respond to lime; they benefit, however, by dressings of slag.

The low-lying Peats.—Like the fen soils, these require drainage before anything can be done, but in addition they require large dressings of lime as, unlike the fen soils, they are strongly acid. When the work is properly carried out reclamation is quite a feasible and often a profitable process. Two general methods are in use :—

(1) The land having been drained, ameliorating substances (such as lime, artificial manures, &c.) are added and the peat is cultivated as if it were normal soil.

(2) The peat is removed and sold, and if the climate allows, the underlying formation is drained if necessary and then either—

(a) Ploughed up;

(b) Covered with town refuse and then cultivated; or

(c) Warped, *i.e.*, systematically flooded with tidal water carrying silt till several feet of soil have been formed; this is possible only in a few areas, *e.g.*, Lincolnshire, lying below high-water level.

The first of these methods is adopted in Ireland and on the Continent: it is much investigated at the Experimental Stations at Jönköping (Sweden), Bremen (Prussia), Munich and at Arnhem (Holland). It has been tried at Wadfast Moor, Cornwall.

Some of the Irish attempts have been described in the Journal of the Irish Department of Agriculture for 1915 by Mr. Duncan. The problem is complicated by the existence of more than one kind of peat, *e.g.*, potash sometimes produces marked effects, and sometimes does not; before any important reclamation could be carried out it is necessary to make a careful study of the kinds of peat concerned. Two Scotch reclamations are described in the Highland Society's Transactions for 1899.*

The Jönköping experiments are carried out under the able direction of Professor von Feilitzen, and are described in the reports issued by the Swedish Society for Moor Culture.†

* Vol. 11, p. 150.

† Abstracts appear from time to time in the Jour. Board Agric.

The Belgian and Dutch methods consist in drainage, then addition of sand,* followed by deep ploughing and liming. The work is done by land reclamation companies† who acquire considerable experience and achieve much success. An interesting feature is the addition of farmyard manure. At first sight this addition of organic matter to a peat soil looks like "carrying coals to Newcastle," but it is founded on successful practice. In Holland it is not unusual to make up a heap of farmyard manure, soil, waste vegetable matter, &c., and leave it for some time to "ripen," and then spread it on the soil at the rate of about 2 tons per acre. The idea is to introduce the necessary soil bacteria into the peat which normally contains quite a different micro-organic flora. After this has been done a plant of clover is said to be obtained with more certainty than before. It is not clear that other crops benefit directly, but of course, any improvement in the clover reacts on the crops coming afterwards.

The second type of method—the removal of the peat and treatment of the underlying soil—has proved more popular in England because the high market-value of peat helps to set off some of the capital cost of the work. The removal and sale of peat is perfectly sound in principle. Peat is an asset of considerable value, but it is essentially a wasting asset: it disappears at a measurable rate after the drainage necessary now-a-days. Under modern conditions peat cannot be conserved for future generations, and we are therefore justified in using it ourselves even if the process be somewhat wasteful.

The best known example is the reclamation of Chat Moss, near Manchester, on which ashpit and other city refuse was carried after the peat was removed. The estate was taken over by the Corporation of Manchester in 1895, and after some adjustments consisted of 2,536½ acres, for which £130,969 was paid. £60,215 was spent on erecting and laying out farms, roads, light railways, &c. The rents during 1915 amounted to £5,313. The very similar Carrington Estate of 1,100 acres was purchased in 1886 for £39,166: nearly £44,000 was spent in drainage, light railways, roads, farm buildings, &c., making the total cost £83,142. The rents during 1915 amounted to £2,110. Thus the increase in agricultural value is not sufficient to carry the whole cost of the improvements: the City, however, gains in other directions in that the areas provide convenient

* Several attempts have been made to find out what the sand does.

† Such as the Nederlandsche heide Maatschappij, Arnheim.

dumping places for its refuse, whilst there is the possibility of further income from the sale of peat.

Another area worked on the same principle is near Edinburgh, where city refuse is carted out and then used for farm land. Again the increased agricultural value does not pay the whole of the cost of the reclamation, the city having to pay for the advantages of having a dump for refuse, and a place where relief works can be carried out.

Carr Soils.—These form an interesting example of peat soils that present some difficulty in management. The name is given to low marshy peat land containing the remains of old trees, birch, alder, &c. The word "Carr" is of Scandinavian origin denoting a marsh. In Nottinghamshire the "Carr" forms a strip of land about 2 miles wide and 15 miles long, lying south of the river Idle and north of the Trias escarpment on which stand Everton, Gringley, &c. The top 9 in. of peat appear to be formed from grass and rushes; the lower 9 in. to 15 in. from decayed wood. There can be little doubt that the upper layer was much thicker when the land was first drained during the Napoleonic Wars, and the original venturers were well repaid by the bounteous crops of rape and oats. The cropping seems to have been of an exhausting nature, and it was made worse by the paring and burning which accompanied it.* With the disappearance of this layer of grass and rush peat through shrinkage and oxidation the lower layer of wood peat has been brought into prominence, and is found not to be very satisfactory material. From the mechanical point of view the tree stumps and roots are a great nuisance, holding up the plough, sometimes even throwing it out of the ground. Regarded chemically, peat formed from wood is of little promise, comparing very unfavourably with that formed from grass or rushes. Without definite trial there could be no certainty that methods successful on a fen would answer on the "Carr." There appears to be evidence of definite plant poisons in the peat, oats and mustard having failed unaccountably.†

The analysis of the soil is as follows:—

	(Upper layer).				(Mid. Agric. Coll.)
Organic matter (loss on ignition)	57.8	
Nitrogen	2.11	
Potash	0.60	
Lime	1.06	
Magnesia	0.28	
Phosphoric acid	0.26	

* R. W. Corringham, J. Roy. Ag. Soc. 1845. Vol. 6. p. 40

† E. E. Stokes, J. Bd. Agric. 1913, 20, 672

Thirty years ago there was still a certain amount of arable cultivation, but it has now declined and the land remains in poor grass, largely Yorkshire fog, which becomes badly infested with rushes. It affords a certain amount of grazing for bullocks and pit ponies.

The land could probably be converted into arable, but two steps would seem to be involved in its reclamation:—

(1) Improved arrangements for drawing off the water, the level of which in the soil is now somewhat too high owing to the shrinkage of the peat.

(2) More body seems to be needed in the soil, especially in the "wood" peat.

The soil is underlain by clay, and the most hopeful method of improvement for the arable land would appear to be the claying process carried out successfully on the "clay" fen in the Isle of Ely. This involves the digging of trenches down to the clay which can then be thrown out; but the peat is light and not deep. On the road across the "Carr," which is bordered by a deep drain, and therefore presumably received some of the clay thrown out during the excavation, there is a considerable development of clover and a vastly better herbage than is afforded by the mass of *Holcus* and rushes in the main part of the "Carr."

(3) Lime and fertilisers would certainly be needed.

The programme probably looks more formidable than it really is, and the position of the land promises a return.

It is possible of course that the area could be warped, as is done on the other side of the river in the Hatfield Chase and Thorne Moor district, and this would be a final and satisfactory solution. This, however, is an engineering problem which the writer is not competent to discuss.

As an alternative, the land could be used for permanent grass, liberally treated with phosphate, mown occasionally to keep down rushes, and periodically reseeded when *Holcus* has become too prominent. Probably the best system would be a combination of the two; using long leys with intervening arable periods.

High-lying Peats.—These present the most difficult case of all because the high rainfall intensifies their naturally wet character, and the coldness makes agriculture very difficult.

Many attempts have been made to reclaim the high lying peats, but few have met with success. Mr. Pell, in the *Journal of the Royal Agricultural Society* for 1887, records a case where

£24 7s. 6d. spent per acre in the reclamation led to an increased annual rental of only 8s. 2d.

The most interesting case is that of Dartmoor. Somewhere about 1780, Mr. Gullet began reclamation on the farm which is now known as Prince Hall, and Mr. Bray began at Bairdown Farm. Gullet was succeeded by Mr. Justice Buller, who, we are informed by Robert Fraser in his Survey of 1794, "finding that his health was greatly improved by the purity of the air," settled on the moor at Prince Hall and started farming; his successor, G. W. Fowler, continued the work from 1846 onwards. But the great 18th century improver of Dartmoor was Sir Thomas Tyrwhitt, of Princetown, an account of whom was published by Mr. J. Bocking-Rowe in the Devon Association Proceedings for 1905.* In 1854, Henry Tanner, estate agent of Exeter, published a prize essay on "The Cultivation of Dartmoor as a source of employment for the unemployed population of the district," and claimed that oats, vetches, clovers, grasses, rape, turnips and swedes could all be grown successfully. He was very hopeful about reclaiming the moor.

An account of the old Prison Farm is given by Mr. F. Punchard, in the Journal of the Royal Agricultural Society for 1890,† showing that land previously rush-covered was then carrying a bullock per acre in summer, while distinctly good results were obtained on arable land. The present day condition of the farm hardly comes up to Mr. Punchard's account, no doubt because of the difference in the amount of labour available.

The land was first trenched, then drained, sown with rape which was fed off with sheep, followed by swedes fed off with sheep also receiving cake and corn, then followed 2 or 3 years of seeds, then barley with which was sown the following mixture of grasses, which were intended to remain permanently: perennial rye 8 lb., Italian rye 4 lb., cocksfoot 8 lb., meadow grass, timothy and meadow foxtail 2 lb. each, fescue 1 lb., cowgrass, trefoil and white clover 3 lb. each, alsike 1 lb.; in all. 34-36 lb. per acre.

During the War a considerable scheme was undertaken by the Duchy of Cornwall, under the supervision of Mr. H. Vendelmans, a Belgian expert.

The area under treatment lies to the east of Princetown. It stands at an altitude ranging from 900 ft. to 1,250 ft. above

* Other information is contained in the notes to "Dartmoor," a poem by N. T. Carrington (1826).

† Series 3, Vol. 1, p. 534.

sea level, and it has a rainfall of 85 to 95 inches. While somewhat warmer than the northern moors it is distinctly cold in spring and autumn. The peat is strongly acid and consists of two layers: the upper about 4 in. in thickness formed of partially decayed vegetation (the heather breaking down more easily and the sedges taking longer); the whole however is difficult to plough; the lower layer is composed of black decomposed material. Below this again comes a dark brown or chocolate coloured layer of earth several inches in thickness, probably at one time the original surface soil until it became covered up by a deposit of peat. It is gritty and stony, but usually it has not formed a continuous hard layer of rock or "pan." It must, however, be broken so as to allow full liberty to plant roots. Underneath lies a considerable depth of reddish brown or yellowish earth with occasional patches of white clay. This is so gritty and contains so many pebbles that it is not likely to prove hopelessly retentive of water; further, it is deep in many places. The lowest layer of all is the granite, from which the whole formation arises. Much of the granite is light coloured. It disintegrates very readily on exposure to weather as is well seen in the little quarry near Two Bridges at the junction of the Tavistock and Princetown Roads.

Assuming the land to remain in arable cultivation the 9 in. of peat now covering it would gradually oxidise and disappear, bringing more and more into prominence this old surface soil; its composition is as follows:—

	Black or chocolate coloured layer (probably original surface soil), 9 in. to 15 in. from present surface.			Reddish earth (original subsoil underlying black layer), 15 in. to 24 in. from present surface.		
	1	2	3 (8 in. to 11 in.)	1	2	3
Fine gravel ...	17.1	7.9	9.2	18.2	13.8	10.8
Coarse sand ...	16.5	19.5	32.1	17.1	16.4	27.0
Fine sand ...	23.3	24.1	20.9	19.5	18.5	20.9
Silt ...	14.7	18.4	11.8	17.0	19.4	17.1
Fine silt ...	9.7	11.5	10.5	11.6	10.6	7.7
Clay ...	2.4	2.8	2.6	4.4	7.4	4.6
Loss on ignition ...	12.4	12.7	10.3	7.8	9.8	8.4
Phosphoric acid (P ₂ O ₅) Total ...	0.03	0.05	0.03	0.04	0.06	0.02
Potash (K ₂ O) Total ...	0.23	0.23	0.28	0.41	0.41	0.44
Nitrogen ...	0.22	0.26	0.22	0.11	0.15	0.12
Carbonates...	Nil	Nil	Trace	Nil	Nil	Trace

This new soil should not prove difficult to cultivate if it were not for the high rainfall, but its fine silt would tend to make it sticky. It is very deficient in plant nutrients, and like the present peat layer would need lime, phosphates, nitrogen and potash; drainage would also be essential.

In general the plan of reclamation proposed by Mr. Vendelmans follows the lines successfully adopted in the low lying peats of Belgium and Holland, viz., deep ploughing followed by the addition of sand. It is not necessary, however, to add sand on Dartmoor as the peat is only about 12 in. thick, and is underlain by a layer of sand which is brought up to the surface during the ploughing.

The first ploughing is very troublesome owing to the uneven nature of the surface. In some places the entire plough fell into a hole 3 ft. deep. Naturally it was impossible to do good work in these circumstances, and a good ploughman accustomed to turn a neat straight furrow would stand aghast at the roughness of some of the first attempts. After this ploughing, the land was left bare for a year; it was then harrowed, limed and ploughed over again. This time much better looking work can be done, and the land now begins to take on a normal appearance.

The land is cut up into fields of about 10 acres, between each pair of which a ditch is ploughed. Between successive pairs it was intended to make a plantation 25 yd. wide to protect the crops from damage by high winds.

The rotation proposed by Mr. Vendelmans had five courses :—

- Buckwheat,
- Winter oats,
- Clover,
- Oats for hay or silage.
- Roots.

All these crops were successfully grown on the trial plots in 1916. The buckwheat was to be sown in May, and cut in August in time to drill the winter oats in September; clover was then to be sown in April. The oats for hay or silage were to be cut while still green, and harvested by the ordinary Belgian method, or made into stack silage as is done by Baron Peers of Bruges.

The field trials of 1916 brought out several important points. The great need of lime was demonstrated; the crops having failed completely on most of the plots from which it was withheld. Even 1 ton of lime per acre was insufficient for oats, though it proved enough for turnips and potatoes. Cabbage and kohl-rabi failed except where potash was supplied; clover also

showed marked need for this fertiliser. Phosphates had striking effects on turnips where lime was present, but not otherwise; they also acted well on oats. With these results established it is not difficult to draw up a scheme of manuring suited to the rotation.

The subsequent years, however, have shown that the original scheme needs modification. A recent examination by the writer showed that much of the vegetable matter was still undecomposed, especially the roots and stalks of the common sedge, locally called Carnation grass (probably *Carex panicea**). But the worst feature is the high rainfall, which is between 80 and 90 inches per annum, and is apt to be accompanied by high winds. One day during my visit I found it impossible to walk over the arable land, although accustomed to rough weather and well protected against the rain. For days afterwards no horses could get on to the land. Oats therefore had not been a success; it had been a sheer impossibility to sow them in time; nor indeed could they have stood up against the wind and rain even if they had been sown fairly early.

The root crops on the other hand—swedes, turnips, rape—were looking well *where lime had been liberally used and could still be found on the surface*. Some of the roots were very fine and the crop was probably about 20 tons per acre; but they were a complete failure on two sections where the lime had been ploughed in, and so carried below the surface.

Cabbage might have succeeded, but they were liable to be blown out of the ground. Finger and toe is unknown in any of the crops.

Grass also does well, and the sown grasses are so marked an improvement on the wild vegetation that the cost of the breaking up will no doubt be repaid by the increased value of the herbage, even without taking any account of the arable crops obtained. Cocksfoot is growing very vigorously, rye grass also persists, and there is a fair take of timothy.

The reclamation must be regarded as an experiment, the results of which will not be certain for some years to come. There is no similar case elsewhere so far as I know. The lines appear to be sound. If the reclamation succeeds it will open up considerable possibilities of future developments; and if it fails after an honest attempt to carry it through, it will have demonstrated the fundamental difficulty of cropping at high altitudes.

* In absence of flowers and seeds identification was impossible.

It is, however, by no means certain that the improvement in the grassland can be effected only by breaking up and resowing after two or three years interval. On some of the old fields basic slag has been used, and the contrast between the slagged and the unslagged part is very marked; the original herbage is poor, but after addition of slag the white clover becomes very prominent without breaking up or reseeded. There is a heavy demand for slag throughout Great Britain for normal farming, but mineral phosphates can be had in quantity and they would be well worth trying. It might be desirable to break up strips of land in among the unbroken grass and then sow with a suitable mixture; these would furnish starting points for colonisation of the wild areas with better grasses and clovers.

At present the Dartmoor farmers take in sheep and cattle for summer grazing on the "Newtakes" and they winter a few beasts of their own; the winter beasts pay the rent and the summer beasts furnish money for living—the grocer's bill, however, being met by eggs, poultry, milk, &c., often by a process almost amounting to barter. The sum payable for summer grazing for the cattle used to be 5s. each, now it is 7s. 6d. or sometimes even 10s. for the season, June to September; for sheep the payment is 30s. per score. The owner bears the loss of the sheep (if any) the farmer being paid for all sent, not simply for those returning (as in the Weald). On one farm of 1,200 acres the farmer was expecting to receive £127 for summer grazing, though in a previous year the tenant had taken 250 cattle and 3,000 sheep, which then brought in £270; this, however, proved too great a strain on the land to allow of repetition.

It seems clear that the introduction of more arable land would increase the amount of roots and hay, and therefore allow of the wintering of more stock; further, that the improvement of the fenced in grassland by means of phosphates would allow of more summer grazing. Thus considerable improvement could be effected without altering the system of husbandry which has the merit that it accords with the psychology of the moorland people, and with their holdings and financial resources. Any increase in the head of stock wintered would necessitate the growing of more oats, and it would be well to try experiments with some of the newer sorts, such as "Yielder," &c., well manured with phosphates to see if they would give better results than the present variety.

THE STARLING: IS IT INJURIOUS TO AGRICULTURE?

WALTER E. COLLINGE, D.Sc., F.L.S.,
The University of St. Andrews.

For many years past there has been taking place a sure but gradual change of opinion with reference to the economic status of the starling, for from one of our most useful wild birds it has become one of the most injurious. Its alarming increase throughout the country threatens our cereal and fruit crops, and the magnitude of the plague is now fully realised.

Writing in April, 1919,* we stated: "At the present time the starling offers a most serious menace to the production of home-grown food, and any further increase in its numbers can only be fraught with the most serious consequences." In the intervening two years the starling has undoubtedly increased to such an extent, and as a result of the great damage done to crops, farmers and fruit growers in all parts of the country realise the seriousness of this bird plague. The causes which have brought about the change in the food habits of one of our commonest wild birds are not at first sight apparent, but a closer study of its habits readily explains the deflection.

The starling is distributed generally throughout the British Isles, and, with the exception of one or two counties in Ireland, is abundant now in all districts. Its remarkable increase during the latter part of the nineteenth century attracted considerable attention, and many theories were advanced as to the cause. Some attributed it to the destruction of birds of prey, others to greater facilities for nesting places, while a growing abundance of food was cited by others. In the writer's opinion, however, it is due, *firstly*, to the security of its nesting site; *secondly*, to the change in its food habits; and *thirdly*, to the autumnal immigration. The increase has steadily continued, and at the present time it is almost as numerous as the house-sparrow. The usual nesting place was in the holes in trees, quarries, cliffs, &c., and these are probably its natural habitation. More recently, however, it has availed itself of the greater security afforded by houses, farm buildings, churches, ruins, &c., and occasionally it builds in the foundations of larger birds' nests. The actual nest is a loose untidy structure, consisting of straw or dried grass, leaves, wool or moss, lined with feathers. Both sexes assist in nest building. Five to

* National Review, 1919, pp. 252-257.

seven pale bluish eggs are laid early in April, and sometimes there is a second brood. Incubation is shared by both sexes, and extends over period of from 12 to 14 days; the fledglings are ready to leave the nest about three weeks later.

As has frequently been pointed out, this bird is most variable in its movements, even from the time of leaving the nest. Its habit of moving about in flocks during the spring and summer months constitutes a grave danger; while later the habit of collecting at special roosts frequently causes much damage to young fir plantations, shrubberies and reed-beds.

It is exceedingly difficult even approximately to estimate the actual number of pairs of breeding birds in this country, but for the purpose of illustrating the rate of increase we will presume that in 1917 there were 100,000 pairs of starlings breeding in Great Britain (which is considerably under the actual figure), and that each pair reared three pairs of young, half of each sex, and that all lived together with their offspring. The progeny and parents in a single year would total 800,000. At the end of 1918 this number would have increased to 3,200,000, the addition in 1919 would make the total 12,800,000, while at the end of 1920 there would be over 51,000,000 birds.

These figures are calculated on the basis of a single brood per year, though in many parts of the country there are two broods. Even allowing for a very high rate of mortality, it is clear that the annual increase is enormous, and supplemented as it is by immigrants, the number of these birds at present is far greater than the country can naturally support.

As the number of starlings has increased annually, a gradual change in the nature of the food consumed by these birds has taken place. There is fairly reasonable evidence to show that in the past the bulk of the food consisted of insects and insect larvæ, slugs, snails, earthworms, millipedes, weed seeds, and wild fruits; in more recent years this has been supplemented by cereals and cultivated fruits and roots. Some writers have affirmed that once the fruit-eating habit is acquired, they refuse the other available food.

As a winter visitor large numbers come to the British Isles from Northern and Central Europe, and others pay a passing visit when *en route* between Continental summer and winter quarters. From observation on the east coast of Scotland the writer can attest to the arrival daily during September, 1915, of flocks of starlings from one to five thousand. In 1916 the

numbers were much smaller, but increased again in 1917. During 1918 they outnumbered anything seen previously. Small flocks were observed on 7th September, and larger ones on the 8th. On the latter date one flock alone must have contained something between 150,000 and 200,000 birds, and on the 9th September a still larger flock was observed. This immigration of course occurs all along the eastern coast of England and Scotland, so that the actual number of arrivals must total many millions. The Continental visitors are darker in colour than our residents, and many of them remain here.

The depredations of this bird are known only too well, and require little further description. During the past two years the writer has visited many farms investigating the damage caused to newly-sown cereals. In some cases as much as 30 per cent. of the seed was eaten. The loss due to re-sowing, where possible, is very great if the high cost of labour is taken into consideration, but where this is not possible it is a direct and enormous loss to the cultivator and to the nation. Again, in fruit growing districts the depredations of this bird become more marked annually, cherries, strawberries, currants, plums of all kinds, and more recently, apples and pears suffer. One grower states: "Only one bird is dangerous to my crops—that is, the starling. He threatens the utter destruction of our strawberry, raspberry, cherry, gooseberry, currant, and some other crops. These birds are said to come here from the marshes as soon as the young are hatched, and they come in millions—in flocks that darken the sky." Another grower writes: "During recent years this bird has increased to such an alarming extent as to be a plague. They come in flocks of tens of thousands, and whilst here commit an enormous amount of damage which must far outweigh any benefits they confer. Each year they seem to grow more plentiful. I am in favour of a very drastic reduction for some time to come."

In order to appreciate clearly the true economic position of the starling, it is necessary that the stomach contents of a large series of individuals should be examined, from various districts, and during each month of the year. Such an examination has been made, and as a result we find that of the total bulk of food consumed in a year 51 per cent. consists of animal matter and 49 per cent. of vegetable matter (see Fig. 1). Examined in further detail we find that the animal matter contains 26.5 per cent. of injurious insects and their larvae, 3.5 per cent. of neutral insects, 2.5 per cent. of beneficial

insects, 8.5 per cent. of earthworms, 6.5 per cent. of slugs and snails, 1.5 per cent. of millipedes, and 2 per cent. of miscellaneous animal matter. The percentages of the different items are expressed diagrammatically in Fig. 2. Further inquiry into the nature of the vegetable matter shows it to consist of 20.5 per cent. of cereals, 2.5 per cent. of cultivated roots and leaves, 15.5 per cent. of cultivated fruits, 7 per cent. of wild fruits and seeds of weeds, and 3.5 per cent. of miscellaneous vegetable matter of a neutral nature (see Fig. 3).

If the monthly averages are examined we find that the percentage of animal matter is greatest in April, May and June, the respective percentages being 65, 92 and 87. The highest percentage of fruit is found in July, August and September, and the highest percentage of cereals in September, October and March. In some districts the total percentage of injuries during the months July to October is nearly 100, in other words, cereals and cultivated fruits form the main items of food during this period of the year.

Summarising the above figures, we find that 36.5 per cent. of the starlings' food constitutes a benefit to the agriculturist, 41 per cent. an injury, and 22.5 per cent. is of a neutral nature. These percentages are expressed diagrammatically in Fig. 4. The difficulty is how to balance these figures. This can be accomplished only by interpreting the economic value of the different items in the light of experience gained in such work.

Let us first examine the nature of the benefits. Amongst the insect food we find large numbers of click-beetles and weevils, a few June bugs, wireworms and many beetle larvæ. (The starling does not consume anything like the number of wireworms that the rook does.) Surface larvæ such as those of the Garden Swift Moth, the Heart and Dart Moth, the Great Yellow Underwing Moth, and the caterpillars of the Winter Moth form a considerable item, also leather-jackets and the larvæ of other Dipterous flies. Slugs and snails constitute the next most important item. Millipedes are occasionally taken, but are not a large item.

All the above-mentioned insects are exceedingly injurious to agricultural and fruit crops, and the number of individual forms destroyed must be very great. It is necessary to bear in mind, however, that the bulk of this kind of food is consumed in April, May and June, that is to say, for a period of about three months the starling is wholly beneficial, for another three months it is partly so, and for the remaining six months it is harmful.

A point in the starling's favour, is the nature of the food brought to the nest by the parent birds during the nesting season, which covers a period of about three weeks. A volumetric analysis of the stomach contents of 40 nestlings shows that injurious insects constitute 89 per cent. of the total bulk of food, neutral insects 1.5 per cent., earth-worms and slugs 6.5 per cent., and miscellaneous matter 3 per cent. Amongst the insects we find the larvæ of the Great Yellow Underwing Moth, various Noctuid and Geometrid larvæ, wireworms, leather-jackets, and many Dipterous larvæ, weevils and numerous small beetles. In addition to feeding the growing and rapacious nestlings upon this diet, there is every reason to suppose that during this period the parent birds also partake of a similar one. It is, however, important to bear in mind that this period is confined to three weeks only, or six where there are two broods, and as we have previously shown, while the animal diet of the adults during April, May and June is remarkably high, it is almost negligible during July, August, September, October and March.

Almost every farmer is aware of the damage done by these birds to autumn and spring sown cereals: large areas of newly sown land are laid waste. In many cases great loss is occasioned by the rooting up of seeds which are not consumed. In a like manner the fruit grower can recount serious damage to strawberry, raspberry, gooseberry, currant, cherry, plum, pear, and apple crops, and here again a large tonnage of fruit is damaged apart from that actually eaten.

The above figures were obtained from investigations on the starling up to the end of 1918, but we are convinced that a new inquiry at the present time would show that the injuries had become greater, and the benefits less, owing to the further increase in the number of individuals. Moreover, if we examine the food of starlings from limited areas we find that in spite of the large number of injurious insects they eat in agricultural districts, the percentage of cereals and cultivated roots is so high that the species must be condemned. In a like manner, in fruit growing districts the injuries far outweigh the benefits conferred. Examined from almost any standpoint the unprejudiced mind can come to one conclusion only, viz., that the starling has long since risen above the "high water mark of abundance" and in consequence is doing more harm than good. In other words we have too many specimens of one species requiring the same kind of food within a limited area, and as the late Professor Beal pointed out, this is the cause in nearly all cases where a bird becomes injurious.

If further evidence were needed against the starling it is supplied by its activities in other countries. When first introduced into Australia it was generally regarded as one of the most beneficial birds to the agriculturist and fruit grower, but with its rapid increase a marked change took place in its food habits to such an extent that in 1905 Mr. C. French, the Victorian Government entomologist, wrote: "There can be no doubt about the starling being a most pernicious enemy to the fruit grower and viticulturist in this State. The starlings are increasing a thousand times faster than their natural food, hence they must avail themselves of such as is obtainable. Once driven to this, an appetite is acquired, and fruit diet being easily obtained, they will not seek any other, even if available. It is pleasing to note that the Shire Councils are offering a bonus for starlings' heads and eggs Valuable insect-eating birds such as Kingfishers, diamond-birds, tree creepers, and tree swallows are being driven out of their nesting places in tree-hollows by swarms of starlings, and before long these insectivorous birds, useful to the farmer and orchardist, will be driven out of the State."

As yet the charge of usurping the nesting places and the destruction of insectivorous birds in this country is not proved, but it is only natural that this should take place as the starling family becomes the preponderating bird-factor in a district. The question naturally arises: "How are we going to attack this problem?" It is by no means an easy one, for any reckless or indiscriminate method of general destruction will only do harm. The object to be sought is not how to exterminate the starling, but how to reduce its numbers and to keep it within reasonable limits so far as the immediate future is concerned. To bring about the desirable end we would suggest the following course of action:—

(1) In all fruit growing and agricultural districts, the systematic collection of the eggs and the destruction of autumn immigrants.

(2) So far as possible, the making of all dwelling houses, farm and out-buildings starling proof, *i.e.*, blocking up all openings or facilities wherein the bird may nest.

(3) More stringent regulations for the protection of birds of prey, such as the Kestrel, Merlin, Hobby, the Tawny or Brown Owl, and the Little Owl.

(4) International co-operation with those countries from which we receive autumn immigrants.

(5) A new inquiry as the starling becomes reduced in

numbers, in order to gauge accurately its food habits under new conditions.

Failing some such action as indicated above, the agriculturist and fruit grower will be left faced with a growing enemy which is devastating their crops, and inimical to their interests, and the country with a portentous factor which is adding to the scarcity of home-grown food. In short, the starling has become a plague in the land and a source of great national loss.

REVERSION OF BLACKCURRANTS:

A METHOD OF IDENTIFICATION.

A. H. LEES, M.A.,

Plant Pathologist, Research Station, Long Ashton, Bristol.

Mr. W. P. SEABROOK recently stated that his experience in inspecting growers' plantations is that not one grower in a hundred really knows when a bush is reverted and when not. With this dictum the present writer heartily agrees. It is, of course, no discredit to the fruit grower that such is the case. There is undoubtedly great difficulty in identifying slight cases, as the disease is very insidious in nature. In most diseases, there is a distinct and well-marked change in the appearance of the plant which soon makes itself evident even to the inexperienced eye. The case of reversion is otherwise. In its initial stages there is no very obvious change in the colour or shape of the leaf. It is only after the disease has advanced somewhat that a change becomes noticeable to the unskilled eye. Even then the colour change is but slight: the chief difference is in the shape.

These facts make identification of the disease, from the grower's point of view, a very difficult one, and it is not surprising, therefore, that most growers do not recognise it until it has reached a comparatively advanced stage. Nevertheless, it is obvious that it is extremely important that some method be found to enable the inexperienced to decide quickly whether or not any given bush in his plantation showed signs of disease. The great loss of crops entailed by it are well known, and in the present state of knowledge the only methods open to the grower of curtailing its ravages are propagation from sound stock and rogueing. In order to keep the disease in check, the latter process must be done both in the cutting beds and in the plantation.

The method about to be described was tested during the 1920 season and found to be uniformly reliable. It enables the observer to detect the disease in its earliest stages, and can be used as a means of identification from about the middle of May until the end of the season, when leaf fall begins. On p. 1125 are shown seven leaves of the blackcurrant. Fig. 1 is a normal leaf, while Fig. 2-7 represent various stages induced by increasing amounts of reversion. There are two main points to observe in Fig. 1:—

(1) **Leaf Venation.**—The blackcurrant leaf venation is palmate in type. That is to say, the chief veins spread out like the palm of the hand, and, in this case, include five members. They all originate at the same point, which is situated at the extreme base, and run to the main points of the leaf, which, for convenience, have been labelled A, B, C, D and E. These may therefore be called main veins. The next point to notice is the number of subsidiary veins running from the median vein or midrib (that running to C) to points on the leaf margin. It should be observed that the vein running to D, being a main vein, is not counted as a subsidiary vein. The first one to count is that immediately above it, running from the midrib to the margin. All the veins can be seen best from the underside. In Fig. 1, there are five of them, numbered 1-5, each of which may be called a submain vein, and each ends in a point in the margin. It will be noticed that not all the points in the margin receive submain veins. As a matter of fact, they are innervated by veins of a lower order, which branch off from the submain veins. These need not be considered, as they are of no use in identifying the disease. The first character, therefore, in identifying the disease is that a normal leaf has at least five submain veins running from the midrib to a point in the margin. Sometimes the number may run up to seven, but never descends below five. Usually, the submain veins on each side of the midrib are the same in number, though slightly different in position: it is immaterial which side is counted.

(2) **The Leaf Margin.**—The second point to note is the character of the leaf margin. In normal leaves, such as those shown in Fig. 1, the margin is finely serrated, and there are a number of pointlets which do not receive a submain vein. This may, if necessary, be reduced to a numerical basis, though in practice it is not usually necessary. Thus, on counting the number of pointlets not receiving submain veins between C and the sinus between C and D (marked X), it is found that there are eight. To sum up: the characters that make a perfectly normal leaf are (a) at least five submain veins, and (b) a finely serrated margin with many pointlets not receiving submain veins. To bring out the points of difference, it is best to compare a typical reverted leaf, as shown in Fig. 4. For convenience of reproduction, only half is shown. This type is a very common one in reverted bushes and will be readily recognised by growers. Here the number of submain veins has been reduced to three, and the margin is noticeably coarse in outline. If

one counts the number of pointlets between C and X not receiving submain veins, one finds the number to be two, as against eight in the normal leaf.

There are, therefore, well marked differences. So well marked are they that the practical grower may say that he could tell the difference by eye, without troubling to count. Nevertheless, the method is of value, as can be shown by a consideration of slighter cases of the disease. Fig. 2-7 represent advancing stages of attack. While Fig. 1 is normal, Fig. 2 is slightly attacked, Fig. 3 more so, and so on until an extreme type is reached in Fig. 7. At first sight, Fig. 2 appears normal, especially as it possesses five submain veins. The margin, however, is much more coarsely serrated than Fig. 1, and has only four pointlets between C and X which do not receive submain veins, as compared with eight in Fig. 1. It has, therefore, a distinct touch of reversion in its make-up, and any bush having such leaves is suspect. In Fig. 3, a further stage is represented. Here, only four submain veins are found, and the margin is still coarser, only two uninnervated pointlets being present between C and X. In Fig. 4—the next stage—there are only three submain veins and two uninnervated pointlets. Fig. 3 and 4 are very common types in cases of reversion. Frequently, no further stage in aberration of leaf type is reached, but sometimes more extreme types are produced, as in Fig. 5-7, where the submain veins are successively reduced to two and a doubtful, two and one. In Fig. 5, the third does not run to the margin, but is twined round in an inward direction. The uninnervated pointlets are reduced to zero in each case. Such types are frequently referred to by growers as "oak leaves." The term is a convenient one, but it must be understood that they grade into the more ordinary types of reverted leaves, of which they are only extreme cases.

It will be observed that in Fig. 1-4 there is a successive comparative elongation of the leaf, which is usually considered by growers to be one of the characters of a reverted leaf. The present writer, however, prefers not to lay emphasis on this character, because though frequently it is a reliable guide, a fuller examination of leaves in the field shows that it is not completely so. One can find cases where reverted leaves are quite broad in shape. The same applies to size. While it is true that in the majority of cases reverted leaves are smaller than normal, it is not always so. For instance, if a

reverted bush grown under good cultural conditions be cut to the ground, the following season's growth has quite large leaves, which, at first sight, appear to be almost normal in shape also, but their reverted state is revealed quickly by the method outlined above. Conversely, small leaves are not necessarily reverted: such leaves, quite normal in character, are produced frequently both at the beginning and at the end of the season.

FIG. 1.

FIG. 2.

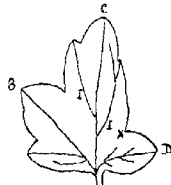
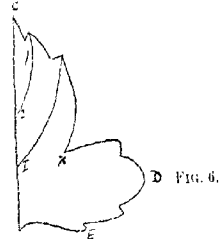
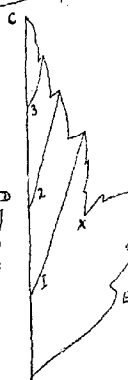
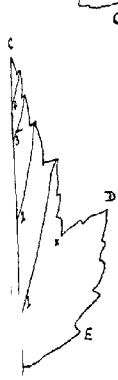
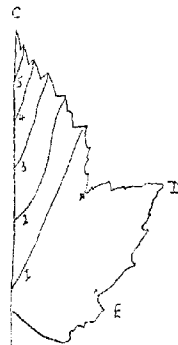
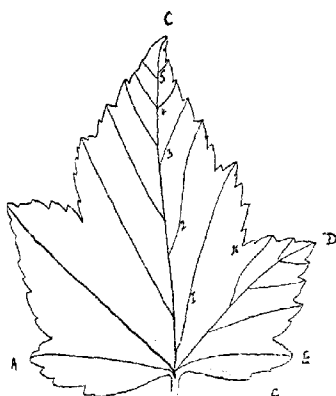


FIG. 3.

FIG. 4.

FIG. 5.

FIG. 7.

Drawings of Blackcurrant Leaves showing successive Stages of Reversion.
The numbers indicate Submain Veins.

FIG. 1.—Normal Leaf.

FIG. 2-7.—Successive Stages of Reversion.

For convenience of comparison, the points already discussed have been summarised in the table given below. The method of identification described above has enabled the course of the disease to be followed in considerably more detail and with greater accuracy than hitherto. The results obtained cannot be described here through lack of space, but they show that a reverted bush may start the season by producing perfectly normal leaves. This, however, does not continue long, perhaps only for a few leaves, but it means that in the early part of the season no attempt should be made to identify the disease

TABLE.

Figure.	No. of Submain Veins.	Character of Margin.	Serration	No. of uninnervated pointlets.
1	5	Normal	Fine	8
2	5	Slightly reverted	Fairly fine	4
3	4	Reverted	Coarse	2
4	3	Reverted	Coarse	2
5	2	Intermediate oak leaf	Very coarse	0
6	2	Oak Leaf	Very coarse	0
7	1	Oak Leaf	Very coarse	0

by this method. By the middle of May, reverted leaves begin to appear, and from this time until the end of June is the period when the disease is most readily recognisable. This fact has long been known to practical growers who do their roguing at this period of the year. It can, however, be done at any later period until the leaf drops, though the process is not quite so simple. In July or August, the May-June leaves do not show at the top of the bush, and since the reverted leaf type is most marked in May-June, more care must be taken. In many cases, the July-August leaves are also abnormal, and though frequently only to the extent shown by Fig. 2, the grower who has trained his eye by the method described in this paper will soon be able to pick out such leaves. All he has to do is to turn back the branches and look for the leaves produced in May-June. If reversion is present, the leaves will show it quite clearly.

Practical Conclusions.—As mentioned above, in the present state of knowledge regarding the disease, the grower has two methods of attack. The first consists of propagation from sound

stock. Now while nurseries in general do their best to send out sound stock, cases have occurred in which reverted bushes have been received from firms of established reputation. This statement is not made in destructive criticism, for the writer is fully aware of the great difficulties experienced by firms in ridding their stock of traces of the disease. But the risk still remains, and is proved by the fact that no firm dare give a guarantee that the stock they send out is free from reversion. There is also a further point to consider, that in the present scarcity of nursery blackcurrants, a grower cannot always obtain the variety he wants. It is, therefore, important that he should be in a position to propagate from his own stock, if he so wishes. In such a case, he should examine his stock in June and mark down individual bushes which, proved by the method described above, are absolutely sound. It is useless as well as dangerous to mark down blocks of bushes unless every bush is inspected, because in a block that appears normal there are frequently some which on closer examination show a trace of the disease. It is best to be on the safe side by using only those that are beyond suspicion. Such bushes should be denuded of every scrap of wood that will serve for a cutting.

The second process of control open to the grower is roguing. This should begin in the cutting beds and end in the plantation. In June of every year, the cutting beds should be examined and every affected bush grubbed and burned. Exactly the same procedure should be adopted in the plantation, except that, since the bushes are fruiting, they should be marked then for destruction after the fruit has been picked. The best method of marking is to break one or more small branches in such a way that they are not completely removed; the dead leaves indicate the disease and the operation does not materially interfere with the crop. By adopting these methods, one large fruit grower has practically eliminated the disease from his plantations.

THE BREEDING AND REARING OF TURKEYS.

C. A. FLATT.

THE breeding of turkeys has long been recognised as an industry of considerable importance in Europe, mainly in France and the southern countries, from which prior to 1914, large and increasing quantities were imported annually to the English markets. Very few data are available as to the extent of turkey breeding, and except that the average turkey population per hundred acres of cultivated land was 2.3 in England and Wales, and 7.2 for Ireland in the year 1908, no reliable figures can be quoted.

Origin of the Turkey.—The origin of the domestic turkey was for some time a subject of controversy, but it is now accepted generally that our domestic varieties are descendents of the North American wild breeds, *Meleagris Americana*, and *M. Mexicana*. The former is a large bird with dark and bronze markings, while the latter is of smaller build, shorter in the leg and with white tipped plumage. It is more than probable that turkeys were first introduced into Europe through Spain, and it is claimed that domestication dates back 500 years. In any case there is evidence of demand for these birds for the table over three centuries ago, and if the earliest specimens first reached Spain they would speedily become distributed throughout Europe at this period.

Breeds.—The most common and popular variety in Great Britain is that known as the American Bronze, and there is no doubt that this breed and the Cambridge Bronze possess the blood of the *M. Americana*, or wild turkey of the more northern climes of America, while the origin of the White or Buff varieties, which are less popular in Great Britain, is probably more directly traceable to the *M. Mexicana*. These breeds, together with the Black Norfolk turkey which is now seldom seen, are the only distinct varieties known in this country. Both the American and the Cambridge Bronze are of large size, and they probably owe this and their superior claim to vigour to the more recent introduction of wild blood. The Black Norfolk, at one time most justly popular for its quality of flesh and propensity to

fatten easily, might clearly be claimed as a purely English variety of the turkey, but owing to lack of care in breeding, very few specimens of this breed are now to be found. While the White turkey alternately termed the "Austrian," and in America the "Holland," is to some extent bred in this country, it does not enjoy the popularity of the Bronze. It has frequently been stated that the White turkey is delicate constitutionally, but this is largely prejudice, and the real explanation of its lack of popularity is probably to be found in its smaller size compared with the Bronze. In reality it is a hardy bird of very good table quality. The Buff turkey has no special claims for the attention of breeders for market purposes.

The Present Position.—Turkey breeding has been slowly but steadily increasing in England and Wales, but to meet the growing demand the increase of imported birds from Ireland and from Europe has been far greater in proportion. During the war period the breeding of turkeys declined, both in this country and in Europe, indeed in some of the southern countries it must have almost ceased, and until the past season of 1920 the importation of foreign turkeys for the Christmas markets was at a very low level. Rapid recovery in breeding can be made as with all classes of poultry stock, and although there was no evidence of a renewal by a return of Italian and Austrian turkeys to our markets, the supplies from France last Christmas exceeded early expectations. In England there was evidence of a considerable increase in rearing during 1920. Large quantities of birds came from Ireland last Christmastide, although the unsettled conditions in that country upset and probably decreased the supplies.

The uncertainty of the supplies available, and the inflated ideas of values resulted in the fixing of a higher value on the turkey last Christmas than the public would pay, and in spite of their popularity at this season, the high price seriously affected the demand for turkeys. The producers had been misled to some extent by the buyers who were anxious to ensure supplies for their more wealthy customers irrespective of cost. The sudden fall in price at the last moment was due largely to the holding up of supplies for the sake of the high prices, and the result was unfortunate for some, while others reaped the benefit. With the gradual return to more normal conditions and prices, it is to be anticipated that the demand will become more measurable and steady, and the apparent slump which occurred this season cannot be taken as an indication of over production.

Turkey rearing is a suitable branch of poultry keeping for many farmers and smallholders, and provided it receives the careful attention which is necessary, turkeys are a most profitable crop. For many years turkey breeding has been practised on a considerable scale on farms in the eastern counties, mainly Norfolk and Cambridgeshire, and the bulk of the finest English turkeys come from this area. With the exception of Devonshire, turkey breeding and rearing cannot be said to be practised generally by farmers in any other part of England, and although in Devon many turkeys are reared, the individual flocks are smaller. This is no doubt due to the smaller area of the farms, and the different nature of the general farming operations.

Conditions Suitable.—While it can be accepted generally that turkeys will thrive better under the drier climate and upon the warmer more freely drained lands of East Anglia, suitable conditions are by no means confined to the counties in which the best of our English turkeys are produced. In North Devon the ruling conditions are exactly the opposite, yet a large quantity of very fine birds are produced here. The intelligent attention which has been given, and the longer experience which has been gained in the subject in the eastern counties is chiefly accountable for superior results. The turkey is more hardy than is conceded generally, and while a dry soil and natural protection from driving rains and cold winds are a necessary condition to the most successful results, the same applies to the keeping of the ordinary fowl, with this difference: Such adverse conditions can be overcome to a large extent with the keeping of fowls, by the adoption of more intensive measures, and the provision of artificial protection. In the case of the turkey this cannot be advocated, as the most essential condition to turkey breeding and rearing is an unrestricted range.

The lighter and better drained soils are a distinct advantage because they are warmer and sweeten more rapidly. Natural shelter is desirable, such as that afforded by woods and thick hedges, but it by no means follows that valleys and low lying ground are preferable, although they may be better protected, since these are frequently damp, and the land at a high altitude which appears to be exposed, will often lend itself better to turkey breeding.

Turkey Breeding.—The practice of keeping a stag turkey with three or four hens is to be seen frequently; this is to be deprecated. The initial cost and maintenance of a stag for this

small number of hens is not economical, in addition to which it is sometimes detrimental to the hens, and frequently an inferior specimen is used in order to avoid the cost of purchasing a more suitable stag bird. Probably this practice is due to the difficulty in securing hatching eggs at a reasonable price; on the other hand there is a failure in many instances to recognise the true value of the hatching egg from carefully selected stock. The difficulty has been overcome to some extent in Ireland by the provision of stud turkeys, and in Scotland by the establishment of stations for the supply of hatching eggs, and has resulted in the breeding of a hardier stock, and a reduction in mortality from the specially selected stock which are secured for the purpose of these schemes. The breeding of turkeys is most profitably carried out by the general farmer who is in a position, if desired, to rear a large flock from his breeding stock. The small holder or specialist poultry farmer, with more intensive methods of utilising the land at his disposal, cannot provide the space and conditions so desirable for a flock of breeding turkeys; the actual breeding can therefore be far better carried out upon farms where unlimited range and natural cover is available for the birds during the greater part of the year. The sale of hatching eggs offers a very profitable field for the farmer.

A turkey stag should be mated to at least 10 hens, and frequently a flock of 15-20 hens can be run with a vigorous bird. A breeding flock of this size is seldom a practical proposition to the small holder or to anyone rearing turkeys in small numbers, unless a trade in hatching eggs is intended. Rearers of small flocks of turkeys would be generally better advised to purchase eggs for hatching, if these are obtainable in the locality at a reasonable price, than to keep adult stock themselves for breeding purposes, unless they are able to arrange to keep two or three hens and take them to stud, but the first is the better alternative in most cases.

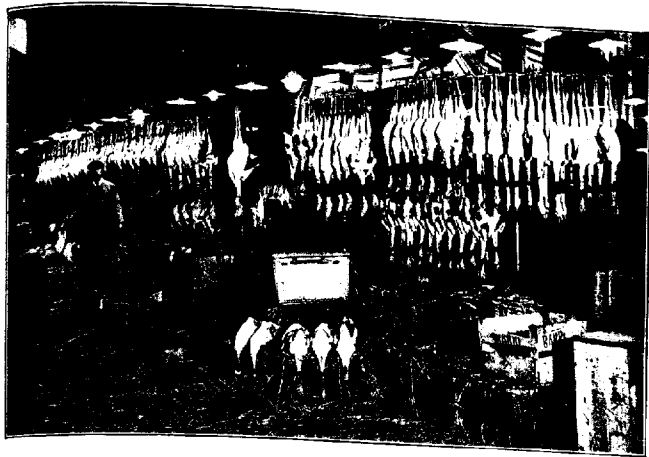
Management.—Careful attention is required in the selection and management of the breeding stock, and there is no doubt that much of the delicacy and losses in the young turkeys is due to carelessness in the selection and treatment of the parent birds. The turkey is an intermittent feeder and dependent upon food from natural sources to a greater extent than the fowl, and as a result the condition of the breeding flock is liable to suffer considerably on a limited range, or to anything approaching poultry soured land. The breeding flock should be kept as far as possible under open air conditions. It is

advisable to provide some roosting shelter during the worst months of the year, for which purpose an open cart shed is very suitable. On the other hand, in order to keep the birds away from the yards, or from the neighbourhood of other poultry stock, it is frequently better to provide a house in the vicinity of a copse, or a stackyard where the birds can obtain shelter from wind and rain.

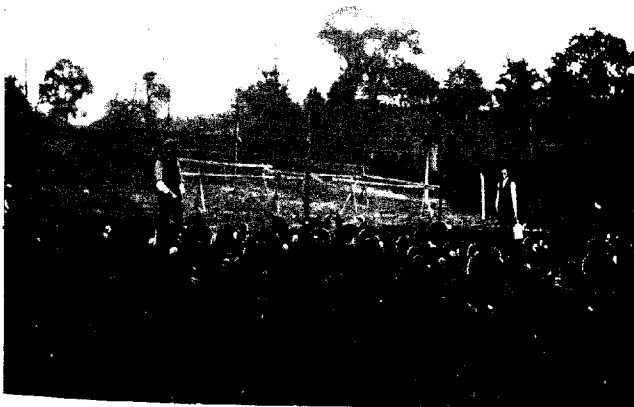
A very simple affair is required as a roost. A framework of rough timber with a thatched roof, and three sides composed of faggots, furze or broom, or of straw, bracken or similar material packed between two layers of wire netting, will suffice. The fourth side should always be open to the air, preferably facing south, and covered with netting for protection against foxes, and for the purpose of controlling the birds in order to save time in finding the eggs. Even if the hens cannot be persuaded to lay in the house, they are more easily tracked to their nests if confined until the attendant arrives to liberate them in the morning. During the summer and autumn months the birds will be better roosting in the trees, and only for their protection from enemies and control for the owners' convenience need a roost house be provided.

The birds are not full grown until 18 months to 2 years of age, and, therefore, at their best for breeding at about this age. Turkeys can be used for this purpose at 10 to 12 months, although it is preferable to use a more mature bird of one sex to mate with young birds of the other. If poults are used the stag bird should not exceed 25 lb. weight, which is small for a 2nd year bird. As an average a male of the Bronze breed weighing 20 lb. to 25 lb. and hens of from 14-16 lb. in the commencement of their first season are desirable, but it is most important that the birds should not have undergone any special preparation in fattening for table before they are set aside for breeding purposes. Every care should be taken to select neat, strong but fine boned birds which are bright and active.

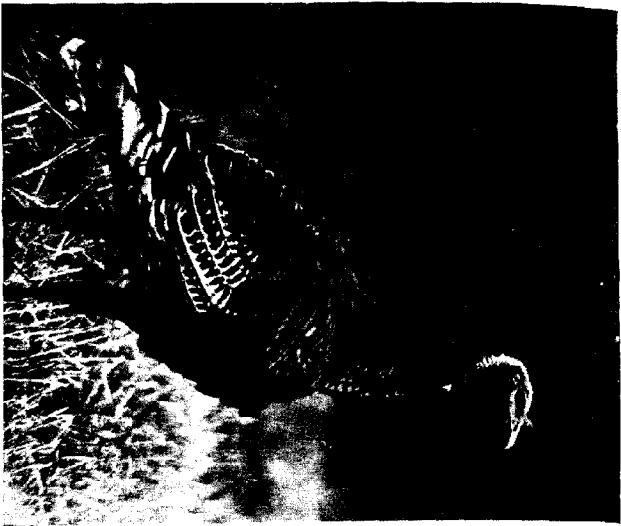
Rearing.—Turkey rearing should not be lightly undertaken; the young birds require intelligent and careful attention for the first eight to ten weeks, and it is questionable whether the time spent in rearing a few birds could not be better employed. A flock of 50 birds takes up very little, if any, more time in attention than one of half the size, and in consequence the labour charge is approximately reduced. Losses in rearing, apart from those due to careless breeding already mentioned, often occur



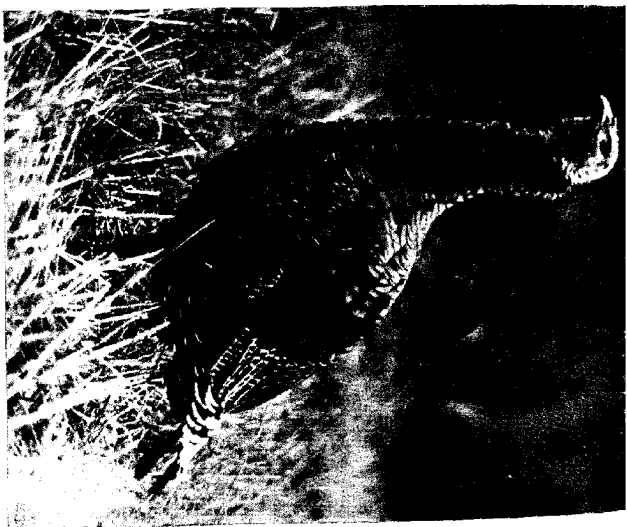
Display of Irish Turkeys in Smithfield Market. The centre Bird weighs 25 lb.



Group of Turkeys reared at Tattingstone, Suffolk. The Birds were hatched on 16th June, 1950, and when marketed at Christmas the average Weight of 27 Stags was 19.9 lb. and of 40 Hens 13.2 lb. The heaviest Stag weighed 22.5 lb. and the heaviest Hen 15 lb. The Price received for the whole Consignment was 2s. 10d. per lb. nett (plucked).



Young Turkey Stag, weight 28 lb.



Young Turkey Hen, weight 18 lb.

through faulty feeding. The young turkeys cannot contend with a large proportion of starchy food. Considerable quantities of green food are required, and this is better if secured in the natural way, although it is necessary to chop it finely and incorporate with the other food when given to the earlier hatches in the first stage.

Food is required only in small quantities at frequent intervals, and although the general methods adopted for chicken rearing can be advocated, a too free use of dry chick mixtures or of scalded biscuit meal cannot be recommended. If biscuit meal is used, it should be squeezed dry and curds given with it. Rice which has been boiled or baked in separated milk is one of the most healthy foods if a proportion of green food is given with it, but this is still better if boiled in the liquid from boiled nettles. Variety is necessary, but the turkey chicks are fastidious feeders, and do not always take a change of food readily; for this reason the use of a small quantity of chopped onion, of which they are generally very fond, mixed with the food, can be recommended. Many young birds die from affections of the liver, and although it should not be thought that the use of medicines of any description is considered generally necessary, signs of sluggishness in the birds may often be corrected with the use of Epsom salts in solution mixed with the meals; on the other hand, upon any symptoms of diarrhoea, a weak solution of catechu (10 gr. to 1 gal.) or sulphate of iron ($\frac{1}{2}$ oz. to 1 gal.) should be added to the drinking water.

The liberal supply of chopped green food already advised applies more particularly to the earlier hatches. When hatching is carried out in May or June the turkey chicks will have better opportunity of securing ample supplies from natural sources.

Late hatching has much in its favour when the birds are only required for table purposes, the warmer and drier months of May and June and the greater abundance of natural food make rearing easier.

An instance of the results which can be secured with late hatched birds is given in the accompanying plate.

Fresh ground upon which to rear the young turkeys is most essential, and a favourite practice is to cut walks in a field of clover on which to place the coops.

Young turkeys suffer to a considerable extent from damp, and from bad ventilation, due to the inadequate accommodation in coops and houses. Turkey coops of large size should always be used in preference to the ordinary hen coop, even though the

rearing is done by a hen. A hen coop may be large enough for 7 or 8 young turkeys for the first week, but they outgrow this long before it is time to remove the mother hen, and the larger coop is not of sufficient size to accommodate the young birds for very long after the hen is taken away. A small open fronted chicken house is probably the most economical for the hen and turkey chicks; this affords ample shelter in bad weather for the chicks, and the accommodation will suffice until the stage when roosting in the open air will be the most satisfactory method, provided there is no risk from foxes or other enemies.

The risk from exposure to wet and cold winds is greatly reduced after the turkeys have reached ten or twelve weeks old, and an ample supply of fresh air in the sleeping quarters, if the provision of these is found necessary, is of chief importance. Unless given a wide range, from this stage onwards, the cost of feeding will be heavy. Facilities for placing the birds upon the stubbles following harvest go a considerable way towards the making of a good profit. In the past it was no uncommon practice for farmers to buy young turkeys in the autumn for placing on the stubbles, finishing them for the Christmas markets, and this proved very profitable. The birds came chiefly from Ireland, but the improved knowledge of the Irish rearers and better facilities for marketing has induced them to market their produce first hand, by which they reap greater benefit. Many birds of the finest quality are now supplied from Ireland.

Marketing.—It should be the chief aim of the producer to secure the trade in the best quality of produce. The English breeder is in a favourable position to market his turkeys in the best possible condition, but will find a keen competitor in Normandy which sends turkeys of very fine quality to the English market. The Irish turkey is undoubtedly the most formidable rival of the English bird of second grade. Of recent years the demand has been for smaller turkeys, and size to some extent has become of secondary importance to quality. The levelling of the price per lb. for large and small birds is an advantage to the producer since it has effected the raising of the price per lb. of the small to that of the larger bird. Even then, provided the quality of the birds are equal, the smaller bird is better value to the consumer. The increase in demand for the smaller birds is, therefore, generally in favour of the growers as the percentage of very large birds is not high. Whether the trade is in large or small birds, quality will have its effect upon the price secured, and it is to the interest of the producer to offer birds of the best type.

For a month or six weeks before Christmas the young turkeys should be specially well fed, but any sudden change of food avoided. Whereas up to this period the birds will have been to a large extent gleaning their own living, supplemented with corn feeding during the final process, barley meal, middlings and ground oats should now be given in a crumbly mash. Maize meal may also be given, but since this has a tendency to lay on yellow fat, only small quantities should be used. The use of separated milk or butter milk for mixing the meal is to be recommended during the final period, and during the last 10 days rough fat which has been reduced by boiling, can be added to the mash. Meat offal may be used occasionally during this period; it should be boiled, chopped small and mixed with the meals, and will frequently serve to stimulate the birds when they show lack of appetite.

The confinement of turkeys while fattening cannot be advocated, and although this and the process of cramming is sometimes adopted for the production of show specimens, it is not recommended for ordinary commercial purposes. Special care should be taken in preparing the birds for market. Turkeys are killed frequently a week or ten days before Christmas, and a preliminary fast of from 24 to 36 hours is necessary. Not only does this free the body from undigested matter, but the blood will drain more freely from the vessels, leaving the flesh a better colour, and the carcass will cool more rapidly, all of which adds to its keeping quality. Turkeys are killed either by piercing the brain with a knife and bleeding through the mouth, or by dislocation of the skull from the neck, when the blood drains into the space. The latter method is preferable from all points of view if properly carried out.

The skin of the turkey is very tender, and care should be exercised both in plucking and in packing to prevent tearing or bruising, which greatly detracts from the appearance. A few feathers are frequently left on the back for the protection of the skin, and it is usual to leave the small feathers at the tip of the wing and the top of the neck; the carcass should otherwise be plucked clean. It is essential that the carcass should be completely chilled before it is packed for sending to market. Large hampers are most suitable when any quantity is to be sent by rail. These are supplied by some of the Railway Companies, and by salesmen for consignments which are intended for them. Clean straw should be used in packing, and it is an advantage to tie white paper round the body of the birds for better protection.

Attention to details which lead to the more attractive appearance of the produce, and the employment of methods required by the particular market supplied, are well worth any additional trouble. It is necessary that the English producer should study the markets' requirements if he is to retain hold of them, and with the improvement in organisation which would come about with increased attention to turkey rearing, this would become a most profitable section upon many more farms.

WOMEN IN HORTICULTURE.

FUTURE PROSPECTS.

KATE BARRATT, D.Sc.

ABOUT thirty years ago, women began to take up gardening as a serious occupation and a means of earning a livelihood. For the few pioneers, faced with prejudices of all kinds, it was uphill work, but gradually, as more and more women were trained, a steadily increasing number found posts as practical gardeners. The majority of these were occupied in private gardens, some as head gardeners, others as assistants. A few made a success of jobbing work in the suburbs of London; others were occupied in nursery or market gardens as owners or employees. Among the women who, from their love of plants and their desire for an outdoor life, had been attracted to horticulture as a profession, were some who became keenly interested in the scientific aspects of the work. These found an outlet for their energies in the teaching profession, and, after a scientific training, obtained posts on the staffs of various schools and colleges. This side of the work, which was naturally attractive to some, offered in addition better remuneration than the purely practical posts.

Soon after the outbreak of war, when the men joined H.M. Forces, those women who had been trained in practical gardening found a rapidly enlarging field for their activities. One of the results of this rather sudden and big demand for women gardeners was the rapid dilution of skilled workers by a number of insufficiently trained women. There is some reason for believing that this influx of semi-skilled labour has reacted unfavourably on the prospects of women gardeners under post-war conditions. Many have found it difficult to obtain positions in competition with men. The rise in the cost of living, consequent upon the War, has had its effect upon horticulture. It has resulted in a drastic reduction in the staffs of many gardens, while the increased rate of wages and a reduction in hours of work has caused many employers to dispense with their women gardeners. Men are undoubtedly better equipped physically for heavy labour than are women, and this has become a very important factor in weighing their respective merits.

In many private gardens, also, the War directly effected the shifting of the centre of interest from the purely decorative to the commercial side. Although many, perhaps most, of the

large ornamental gardens of the country are still carefully maintained, in many others the fruit and vegetable gardens are now expected to bring in some return. On the other hand, market gardening benefited from the general rise in food prices, and has become a far more important branch of the profession than formerly, although at the present time the prices of vegetables to the grower scarcely cover the cost of cultivation.

The two factors mentioned have directly affected the employment of women. In commercial work, although a certain standard of quality must necessarily be maintained, quantity of production is of greater importance, and it is here that the physical disabilities of women prove a handicap in competition with men.

A consideration of these facts points to the necessity of women devoting themselves to those branches of horticultural work for which they are best suited. They must specialise in those directions in which their lack of physical strength imposes least handicap, and in which they have opportunities of exhibiting the special aptitudes of their sex. They must always be prepared to offer the advantage of quality in their work to compensate for the possible lack of quantity. There are certain branches of gardening for which women are specially qualified—for example, propagating work, packing produce, handling seed, glass-house work, flower and bulb cultivation. The remuneration offered to practical workers is not high, and, at the best of times, only provides a living wage, so that it is necessary to find compensation in the delight of an open air life amidst congenial surroundings.

The various openings for women in horticulture may be classified under several heads:—

1. Private Gardens.—There is still a limited demand for women as gardeners in private establishments, and this demand will probably always exist. While in some cases the woman is engaged on account of her practical ability, in others the employers are themselves women and prefer the advantages which result from the companionship of an educated woman as gardener. The wages offered average from 30s. a week for an inexperienced girl just out of college to 50s. or 60s. with cottage, vegetables, &c., for a head gardener. It is necessary for the woman gardener to be devoted to her work, for the life is often a solitary one, with continuous hard work and very little holiday. Without experiencing the joys which gardening brings to real lovers of gardens, the woman gardener's life would be unbearable.

2. Nursery Work.—This is a branch of horticulture which offers an opening to a limited number of women as employees. The bulk of nursery work will always fall to men, for the reasons already stated; the average man is capable of a greater output of manual labour, and is, therefore, certain to be employed in preference to a woman for most purposes. Women, however, have shown a very decided aptitude for certain sides of the work, especially in the many processes concerned with propagation. They learn quickly, and they are dexterous as well as careful in their manipulation. It is clear that if women are to succeed at this kind of work, they must be thoroughly interested in it and spare no efforts to perfect their skill in the practical operations, because there will only be room for those who show themselves superior in technique to the average man. The wages offered are very similar to those paid in private gardens, and here, also, responsibilities carry an increased wage.

3. Small-holdings, Fruit and Market Gardens.—At the present time this department of horticulture is being explored, and tested by women. Opportunities for obtaining the initial experience are still rather difficult to find, apart from the instruction given in various schools and colleges. Many women were employed in market gardens while the men were on Active Service; others joined the Land Army and obtained varied experience in farm work. A few of the latter are now starting small holdings of their own, either independently or in co-operation. The progress of some of the experimental colonies recently projected will be watched with profound interest, because, if successful, they will point a way in which suitably equipped women may find a useful and congenial occupation. This branch of horticulture, however, can only be open to those with sufficient capital to start ventures of their own and provide outside labour for the heavy work. Further, it demands other qualities than those required by an employee in a nursery or private garden, for clearly the grower should have some bent towards commercial life. No doubt, however, the development of co-operative buying and selling will help those who have but little experience of business methods. The small-holder, therefore, requires considerable all-round ability, since it must be remembered that she has always to face the risk of losing her capital.

4. Suitable Employment for Trained Women.—The majority of women gardeners have been drawn from the ranks of educated women, and have received their early training in a college in a scientific atmosphere. Hence it is not surprising to find that a small proportion of them have been sufficiently

interested in the scientific aspects of the work to seek further training and to find employment in which they could utilize the knowledge thus acquired. The openings in this direction have developed very much in recent years, and offer a splendid field for women with a love for the work and the necessary ability to carry it out. They may be grouped as follows:—

(a) *Teachers in Schools and Colleges.*—The demand for women teachers has always been greater than the supply. This is due largely to the fact that no special courses of training have been arranged for students wishing to take up teaching work. Students desiring to teach gardening, together with such subjects as botany and nature study, have taken the ordinary course at a horticultural college and followed it up by further study at a university. This has meant a very long period of training which has been possible only to a few. A considerable shortening of the time involved might be effected if some of the horticultural colleges already providing a good all-round practical training, combined with this a more extended course suitable for the preparation of teachers of gardening, and the theoretical subjects associated with it. At present, the majority of teachers of botany in girls' schools receive an academic training in a college, which is usually situated in a town, with little or no opportunity of acquiring a practical knowledge of the living plant. Surely it would be far better for these women to receive their theoretical instruction at an institution which can also illustrate and develop theory in the field and garden. Teachers thus equipped would be able to bring new ideals and a new standard to the teaching of botany in schools, and could foster in their pupils that love and understanding of gardening and rural pursuits which is so desirable.

(b) *Instructors and Inspectors in Horticulture.*—The educative value of gardening in rural schools is now generally admitted, and in order to extend it many county councils have appointed instructors and inspectors in horticulture. Their duties vary in different parts of the country, but generally they are expected to instruct in school gardening, to keep in touch with rural schools, to give help and advice in educational questions touching their subject, and frequently to give lectures and demonstrations to adults. Several women have already been appointed to such posts, and there is no reason why more should not fit themselves for the work. It demands a wide experience of practical horticulture as well as a sound knowledge of the fundamental scientific principles underlying it.

(c) *Research Work.*—Finally, there are openings for women

in horticultural research work. Women with the necessary training, who have a keen interest in such scientific problems as plant-breeding, plant pathology and physiology can now find opportunities to carry out investigations in these subjects. It must, however, be pointed out that research workers are required to be of a high order of efficiency; they should be highly trained botanists and chemists, and, in addition, they should have had a practical training in horticulture. The woman gardener who has the ability and can afford to undertake the necessary scientific training should prove eminently suitable for such work.

There remains one question which deserves consideration, and that is the type of woman who is likely to "make good" as a practical gardener. Before the War, women gardeners were almost without exception drawn from the educated classes. This was due to the fact that the necessary practical training could only be obtained at a college or gardening school, and was, consequently, restricted to those who could afford to pay the fees. Incidentally, the colleges were obliged to devote a considerable part of their courses to the teaching of elementary garden operations. Such knowledge was acquired by boys and improvers at no expense to themselves. The War, however, introduced new conditions which react in two ways on the entry of women into horticulture. In the first place, it opened the door of many gardens to women as learners and improvers, with the result that it is now possible for them to obtain the initial *practical* training outside the colleges and schools. It is to be hoped that this will have a marked effect on the work of the gardening schools in the future by raising the grade of instruction given and ensuring that it shall be of a more advanced and specialised character. In the second place, the necessities of war produced a new type of woman gardener. Large numbers of working class girls were attracted to the Land Army and experienced the joys of a life in the open. Some of them continued their work and are still employed in nurseries and private gardens. These women may become imbued with a desire to learn something of the scientific principles underlying the manual operations which they are carrying out. If so, the need can be met in two ways, (1) by the provision of suitable instruction at the developing Farm Institutes, and (2) by the establishment of bursaries and scholarships tenable at the recognised gardening colleges and awarded only to those women already in the profession who cannot afford a scientific course.

WITHER-TIP AND BROWN ROT OF PLUMS.

THE decay of ripe plums known as Brown Rot is a disease familiar to all growers. It is a serious trouble wherever this fruit is cultivated, and the losses due to the disease, both on the trees and in market consignments, are often very heavy. The attack by the Brown Rot fungus on the flowers and shoots of the Plum Tree, which is known as "Blossom-Wilt and Wither-Tip" respectively is quite as serious, and at times more serious, and has only recently been recognised and carefully studied. The details of the various Brown Rot fungi and their method of attack have been followed with extreme care and minuteness by Dr. H. Wormald, of Wye College, to whom practically the whole of our knowledge of Brown Rots, as they occur on fruit trees in this country, is due, and on whose work this article is based.

The fungus concerned in the various attacks on plums is *Monilia cinerea*, forma *pruni*. It is a form of this same species (*M. cinerea*, forma *mali*) which causes the Blossom-Wilt of apple. The two forms, however, are quite distinct. The plum form is apparently unable to cause Blossom-Wilt of apples and the apple form has not been found on plums. This should be a matter of considerable satisfaction to growers when the number of apple orchards interplanted with plums is considered.

Brown Rot of cherries is caused by the same fungus as Brown Rot of plums, and in this case, also, it attacks the blossom and the wood as well as the fruit. The description given in this article, and also the control measures recommended, would apply equally to cherries.

Blossom-Wilt.—The Brown-Rot fungus produces a Blossom-Wilt of plums similar to that found on apples (see Leaflet 312). In the spring, spores derived from the mummied plums on the trees, and from spore-pustules on infected wood, are blown on to the flowers. The spores readily infect the stigma, and the mycelium of the fungus passes down the style and causes the death of the flowers (Fig. 1 and 2). The mycelium subsequently passes through the flower-stalk into the wood and attacks the

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FIG. 1.—Blossom-Wilt. The lower flower, which was inoculated 5 days previously, shows the style, continuing to turn black.



FIG. 2.—The same 9 days after inoculation. The only leaves of the lower flower have collapsed and the



FIG. 3.—A typical case of Wilt-Top. Infection above the node in the petiole extending into the shoot, caused the wilting of the terminal portion.



FIG. 4.—Wilt-Top as seen in winter and spring, showing the dead leaves, which often remain attached, and the shoot



FIG. 5.—Mummified phloem. The portions are seen on the central phloem and are, according to becoming mummified and producing spores.

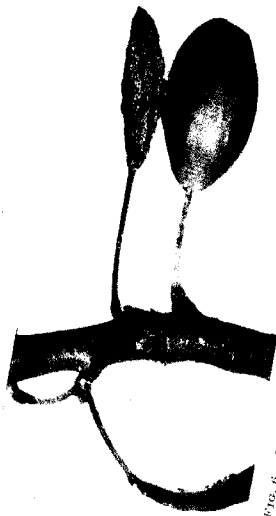


FIG. 6.—Brown Rot. Showing the death of a young plant caused by the Brown Rot fungus and the subsequent infection, by means of direct contact, of the host plant. Spore-fructifications are abundant on the dead plant.

shoots. Trees which have suffered from Blossom-Wilt may be recognised by the brown, withered leaves which usually remain attached instead of falling off.

The damage caused by Blossom-Wilt is very serious in certain seasons. The factors chiefly contributing to an epidemic attack are a low temperature, and a very moist atmosphere during the flowering period. The former retards the development of the flowers, and causes them to remain susceptible to infection for a longer period than usual, and the latter favours the production, by means of the pustules on mummied fruit and dead wood, of an abundance of spores.

Wither-Tip.—In Wither-Tip the fungus attacks the young green shoots and causes them to die-back. In this way many of the leading shoots are killed, and the buds at the base are then stimulated to precocious development, and instead of fruit buds, a number of weak, ill-ripened shoots are produced.

The Wither-Tip form arises from spores formed on the spore-pustules on mummies, on wood attacked the previous season, and probably also from flowers killed by Blossom-Wilt. It usually appears about the end of April or the beginning of May, when some of the young shoots may be seen to wither. The wilt does not always begin at the tip of the shoot; it may commence some distance down, the fungus in this case entering at a node or through a leaf. In Figure 3, the dark portion of the shoot shows the infected area, the fungus having gained infection through the leaf on the left. Shoots attacked by Wither-Tip hang downwards; at first they are flaccid, but later the tissues harden and dry, and the dead shoots may be recognised by the characteristic curve. The dead brown leaves, being killed prematurely, do not usually fall from the tree, but hang on during winter and even until spring (Fig. 4). When it is a spur that is invaded the fungus sometimes forms a canker similar to that formed in apples.

Spore-pustules develop during the following winter and spring, on all the shoots and spurs which have been killed (Fig. 4, specimen to left), and these give off spores which provide for the fresh infection in spring. The pustules are small and grey in colour, they commence to show in December, and increase in number as spring advances. Large quantities of spores are liberated in March, April and May. The fungus in dead twigs may retain its vitality for more than one season, and liberate a crop of spores during the second winter after attack. The importance, therefore, of removing such shoots is obvious.

The severity of Wither-Tip is greater in some seasons than in others. Wet, cold weather in spring favours its development, but since epidemics of Wither-Tip have been found to correspond with severe attacks of aphids, it is possible there may be a connection between them. The aphides, by puncturing the leaves, would injure the tissues, and render them particularly susceptible to invasion by the fungus mycelium.

Brown Rot on Fruit.—The fruit is more often attacked when approaching maturity, the slightest wound or bruise allowing the spores to penetrate and bring about infection. Once it has gained an entrance the mycelium rapidly destroys the fruit, and finally reduces it to the hard, wrinkled structure known as a "mummy." The mummies may fall to the ground, but usually they remain on the tree until spring, stuck together in groups of two or three by means of the fungus mycelium (Fig. 5).

Although it is on-ripe or nearly ripe fruit that Brown Rot is best known it may also attack young fruits. These may be infected by direct contact with mummies or with other diseased fruit (Fig. 6), but apart from this it is clear that wounds or abrasions of the surface are necessary for infection. Soon after the fruits are infected, small grey spore-pustules appear, often in concentric rings.* The spores liberated from these pustules infect other fruits. When the fruit is destroyed, and the dry mummy stage is reached, the pustules for the most part cease forming spores and remain dormant till spring, when they regain their activity, liberate myriads of spores, and thus bring about new attacks of Blossom-Wilt and Wither-Tip.

Varietal Susceptibility.—With regard to Blossom-Wilt and Wither-Tip, as a general rule Victoria and Czar Plums suffer most. In 1920 the attack on these varieties in East Anglia was particularly severe, and it was estimated that 80 per cent. of the flowers and shoots were killed in certain districts. Later in the season the trees made new growth but this was very weak, and on Victoria especially much of it was subsequently killed. Occasionally Monarch Plums suffer more extensively than either of the above. Pond's Seedling and River's Early are not usually so severely attacked.

The fruit-rot form is common on all varieties, although if trees are extensively affected with Blossom-Wilt and Wither-Tip the likelihood of the fruit becoming attacked by Brown Rot is greater.

*It may be noted that Apple Brown Rot (*M. fructigena*) which is distinguished by its buff instead of grey pustules, is sometimes found on ripe plums causing a rot. It appears, however, to be confined to such fruit and not to attack flowers or shoots.

Control Measures.—At present there are three methods of treatment, as indicated below :—

(a) *Removal of affected fruits and mummies.*—It cannot be understood too clearly that new infections are mainly brought about by the mummies hanging on the trees, and by diseased twigs. Diseased and decayed plums should therefore be picked and dropped to the ground at the same time as the crop is gathered. Any mummies that are left on the tree should be removed in winter before the buds swell. They should be collected and burned or deeply buried.

(b) *Cutting out of diseased shoots.*—As far as possible all dead twigs bearing pustules should be cut out, and if the attack is not extensive it will be possible to do this without excessive labour or serious injury to the trees. If large areas are concerned the labour is of course prohibitive, and the trees may be injured through excessive cutting out. At the same time, it should be remembered that the affected wood is quite dead, and therefore useless.

(c) *Spraying.*—In spraying the aim is to destroy the spore-pustules on the wood by means of a caustic winter wash, but the treatment is only in an experimental stage. The chief difficulty is to wet the pustules thoroughly, as on account of their powdery nature, the spraying fluid runs off. This can partly be overcome by the addition of soft soap. The mixture which has proved most promising is as follows :—

1 lb. caustic soda.

1 lb. soft soap.

10 gal. water.

The best time for applying a winter wash depends to some extent upon the season. It should be applied as late as possible, but not too late to run the risk of damaging the opening buds. Generally speaking, the correct time is about the end of February or the beginning of March, but in a cold, late season the spraying might be delayed until the end of March.

POTATO DISEASE (BLIGHT) IN 1920.

THE continual wet weather of the summer of 1920 gave rise to fears (not unfounded) that there would be a very severe outbreak of Blight, with considerably lessened production in consequence. That these fears were not confirmed to the full appears to be due to the fact that the wet was accompanied by continued cold. Once again it was found that excessive wet alone is not sufficient to cause a "Blight year"; a high temperature is also necessary if the fungus is to become rampant. Volkart,* in a Swiss paper states that the fungus (*Phytophthora infestans*) does not develop and spread until the temperature attains 20° C. (68° F.), and this is borne out by seasons such as the present.

The first signs of the disease in the South West were observed in the Penzance district as early as 30th April, and it was fairly general there by the second week in May. By June it had attacked the main crops and by July it was prevalent throughout Cornwall; many parts of Devon and Dorset, and was appearing in Somerset. In the meantime it appeared in other districts, especially in Lincolnshire (one exceptional case was reported the third week in April) and by the middle of June it was of common occurrence, and in July it was present throughout most of the country.

In low-lying and marshy districts, especially where sea mists are common, so that there is almost constantly a damp atmosphere, the disease was bad. Such areas were noticed in 1920 in both Lincolnshire and Sussex.

On the higher grounds in Lincolnshire and elsewhere the disease was later in appearing and not so bad when it did appear. The same applied further north, although disease became very bad towards the end of the season in Lancashire. This was especially the case on heavy soils, and disease in such cases considerably reduced the crop, which was already poor owing to difficulty of cultivating and late planting due to continued wet. On the other hand, disease was not as evident on the lighter soils, and as the wet season suited these, heavy crops largely free from blight were obtained. It was a general occurrence this season to find that, notwithstanding the almost universal appearance of blight on the haulms, the tubers from light soils were remarkably free, while on the heavy soils the trouble was so prevalent on the tubers as severely to reduce the crop and make clamping almost impossible owing to the further risk of rotting.

On the whole very little spraying was done. Owing to varying

* A. Volkart, Landw. Jahrb. d. Schweiz., Jahrg. 33, 1919, p. 38 [Abs. in Centr. f. Bakt. 51, 1920].



UNSPRAYED.

SPRAYED TWICE.

and conflicting reports, more especially as to the scorching of haulms, and the fact that it was difficult to get machines and materials, very few allotment holders sprayed at all. When spraying was carried out on allotments it appeared successful, but owing to the absence of "controls" the freedom from blight may have been due to other causes. Against this may be set the fact that many cases of success were noted by Inspectors where there were "controls" or adjoining fields for comparison.

In Bedfordshire, in a field of potatoes which had been sprayed twice, the haulms were green long after those of the unsprayed crops of neighbouring farms had died down. It is worth mentioning that in this county, dry spraying is said to be successful, although if water is readily available, a wet spray seems to give slightly better results. Good results were noted in Lincolnshire where a large number of growers spray, and they find that increased crops result. In Kent also, the spraying of potatoes is largely practised by farmers, and here again, sprayed fields remain green much longer than unsprayed fields and give a bigger and cleaner crop. Unsprayed haulms were reported to have gone off as early as the first week in August. A fair amount of spraying is done in East Sussex, and approximately 25 per cent. of the farmers are said to spray their potatoes. The illustration of a field of potatoes in Pevensy, taken about the end of September last, shows the bare stems in the unsprayed portion of the field, and the green haulms in the other part of the field which had been sprayed twice.

There is need for attention to be given in the South Western districts, which are particularly liable to blight, to the selection of varieties more or less resistant. Notwithstanding repeated statements that blight-free varieties exist, no variety has yet been discovered which is immune from this disease. There is, however, a varying resistance under ordinary conditions of which more use might be made. It is well known that Up-to-Date and British Queen are particularly susceptible, and in 1920 Duke of York was reported as taking Blight badly in Lincolnshire. On the other hand, the President type (President, Iron Duke, Scottish Farmer), Northern Star type (Northern Star, Allies, Ajax), Evergood, Kerr's Pink, Templar, Arran Victory, Irish Chieftain, Golden Wonder, Champion, Flourball and Shamrock, all show more or less resistance to this disease, and where suitable should be planted. In cases where the soil is heavy and wet, second earlies such as Great Scot, Royal Kidney, Ally. &c., should be planted so that they can be lifted and clamped dry before the autumn rains set in.

DEPUTATION FROM THE PARLIAMENTARY COMMITTEE OF THE TRADE UNION CONGRESS.

On 8th February, Sir Arthur Griffith-Boscawen, M.P., received a Deputation from the Parliamentary Committee of the Trade Union Congress when Mr. R. B. Walker drew attention to the following Resolution of the Congress :—

“ That this Congress while recognising that the land problem cannot be effectively dealt with outside national ownership and control, nevertheless believes that immediate steps should be taken to secure the compulsory cultivation of all agricultural land.”

Mr. Walker declared that more than 240,000 acres had gone out of cultivation in 1920, while 480,000 acres had gone out of cultivation in two years. In passing, he criticised the effective representation of labour on certain of the Agricultural County Committees, and then pointed out that there had been a large reduction in the number of farm labourers since 1911. He claimed, too, that since 1903, in spite of the Small Holdings Act that came five years later, the number of small holdings in this country showed an actual decline from 433,000 to 417,000. In conclusion, he asked (1) for more extended cultivation, (2) for further investigation into wheat growing, (3) for stricter supervision over acts of husbandry, (4) for a vigorous housing policy.

In reply, Sir Arthur Griffith-Boscawen pointed out that the term “ out of cultivation ” was very carelessly applied by many people who used it. Cultivation was often meant to imply arable cultivation, but unless that was the limited sense in which the term was used by Mr. R. B. Walker, he would like to say that land had not gone out of cultivation; indeed there was very little uncultivated land in this country. Land properly laid down to grass could not be described as having gone out of cultivation. A certain amount of land awaited reclamation, but the Ministry's experiences showed that this reclamation might exceed the value of the land reclaimed. With regard to the shrinkage in the area under cultivation in the broadest sense, it was well to remember that urban England and Wales were extending their boundaries day by day, month by month and year by year; where the field is the outskirts of the town to-day the suburb will replace it to-morrow,

and in purely rural centres the factory appears suddenly in the midst of fields shortly to be the centre of a colony of houses built to house the workers. So, while industry grows and the area of our island kingdom remains stationary, there is a steady and cumulative inroad upon the cultivable area. As far as proper acts of husbandry are concerned, he looked to the Agriculture Act to set up a higher standard than exists at present, for that was its object and that will be its aim. Guaranteed prices for wheat and oats, and compensation for disturbance would prove but of little value to farmers whose acts of husbandry were not above suspicion, and he thought that Agricultural Committees would be justly critical of their county's effort. Farmers who did not cultivate according to the new and much stricter definition of good husbandry would get neither the guaranteed prices nor the compensation for disturbance. The Government desired, and the Ministry of Agriculture had pursued, a policy of extended arable cultivation. Both wished to see a much higher percentage of land under the plough, and to this end they had instituted a policy of stimulation, since Parliament would not renew the compulsory powers contained in the Corn Production Act. It should be remembered that the Act only guarantees farmers against serious loss; it does not, and cannot guarantee them a profit on their corn-growing, and consequently the farmer has to look at the situation with an eye that embraces the triple factor of prices, wages and hours. Unfortunately, the decline in prices, the rise in wages and the diminution of hours had re-acted upon the farmer and many now were playing for safety. But, while the Ministry admitted the danger of this safety policy being carried too far, and was working hopefully to restore the proper balance between arable and grass, this could only be obtained by giving the farmer confidence. Compulsion would never serve, because it was impossible to compel any man to carry on business at a loss, and if the farmer would not extend his tillage by reason of the danger to his solvency, there was nobody to do it for him. The State could not and would not turn farmer. The Premier's statement at the Caxton Hall, to which Mr. Walker had referred, applied not only to arable but to grass, but whatever the needs or desires of the country might be, it was impossible for the Ministry to overlook the economic factor. There were only two ways by which this factor could be ruled out. The first was by a heavy subsidy to the farmer; the second was by a heavy tariff on

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imported wheat. Needless to say, the country at large would accept neither, and consequently the Ministry's policy must be to improve the standard of husbandry and so retard the return to grass, while seeing that the grass itself was raised to a high standard of feeding value. A campaign of practical instruction, in which demonstration plots played a large part, was in active operation.

Land Settlement and Small Holdings.—Mr. Walker had pointed out in connection with this question that the small holdings were fewer in 1903 than they were in 1920, but small holdings and small holders, too, were dependent upon economic forces and thousands of small holdings which were situated in the neighbourhood of towns in 1903 were to-day, in 1921, a part of those towns, their very existence forgotten. So far as the Government Land Settlement Scheme was concerned, it should be remembered in fairness to those who had borne the burden of the work, that down to 1919 the Ministry had very small powers indeed. A short eighteen months ago the Land Settlement (Facilities) Act cleared the road, and since then they had been buying land, parcelling it out and putting up houses and farm buildings. Their record in the face of building difficulties well known to all present, was one of which there was no reason to be ashamed. Already 12,431 men had been settled; 16,373 additional applicants had been approved and were taking settlement, and it was expected that there were 5,700 more to be settled, or 34,500 in all—in England and Wales. Of this very considerable number, in the face of all the difficulties attending upon getting work done, more than one-third were settled on holdings averaging about 13½ acres per man. The equipment averaged about £350 per settlement and the total area of land acquired for settlement was 350 square miles.

Continuing, he pointed out that there are two sides to the small holding question, and both required careful consideration by those who represent the worker. Small holdings in many cases have dispossessed the farmer, and, with the farmer, those who worked for him. While on a highly cultivated mixed farm of, say, 400 acres, a dozen or fifteen men might be employed, when that farm was taken, as in certain cases it had been necessary to take it for small holdings, the workers, as well as the farmer, were dispossessed. The ex-Service man was not only granted a holding at a rent he can reasonably be expected to pay, the cost of purchase or hire and equipment of land being paid out of the Government grant of 20 millions, but he was entitled

to borrow from the County Council for the purpose of stocking his holding £1 for every £1 of his own, up to £500. In this way his settlement was facilitated further. Another point that he would emphasise was that land that had been bought for settlement was representative of the best land in England. It had been the Ministry's care to select soil on which the small holder might make good, and consequently, whatever changes there might be in settlement, the land would always offer a living to those who worked upon it wisely and with a will. In counties where land for small holdings had been badly chosen in years past, derelict fields and deserted buildings alone remained.

In reply to a question from a member of the Deputation who enquired whether the Ministry of Agriculture issued information on agricultural subjects, Sir Daniel Hall pointed out that every aspect of agricultural activity is dealt with in leaflets, which are issued free of charge, not only to farmers but to every applicant who is concerned with working the soil of this country to obtain any sort of return. Sir Arthur Boscawen added that, in his opinion, the best way in the long run to help agriculture was by the promotion of research to acquire new knowledge and by dissemination of that knowledge among farmers and others who work on the land.

NOTES ON MANURES FOR MARCH.

E. J. RUSSELL, D.Sc., F.R.S.,

Rothamsted Experimental Station, Harpenden, Herts.

Lime.—Correspondence in regard to lime is still abundant, and again it must be urged that lime or limestone must be applied to sour arable land before satisfactory improvement can be effected. In many districts drainage is equally necessary, and money is wasted if expended upon lime without drainage. In other districts, as on the flinty clays of the Home Counties, lime or chalk is quite sufficient. The effect is being shown in a marked way at the present time on the Rothamsted fields, the soil of which is a sticky, heavy loam. Plots and fields that have received chalk are in a favourable workable condition; those that have not are sticky. Usually the difference in crop is less than might be expected, excepting in the case of clover which has to remain throughout the winter in whatever conditions exist, and suffers accordingly. There is a marked difference in ease of working in spring. It is impossible to obtain reliable figures as to cost from plots, but there can be little doubt that a good dressing of chalk saves spring cultivations for a number of years.

There is usually reliable local information on these matters; the point of the present note is to urge that *no substitute is known for liming or chalking of arable land*. On pasture land basic slag often proves more satisfactory, and to that extent may be considered as a substitute.

Between lime, limestone and chalk the choice is determined partly by soil and partly by convenience:—

(1) On heavy soils all are equally effective, but lime is the most concentrated, and therefore often the most economical. In the Home Counties, however, chalk is often found the most economical.

(2) On light soils ground chalk or limestone is often safer than lime, as less loss of valuable organic matter results therefrom.

(3) On peat soils lime is more economical than limestone or chalk owing to transport costs.

Importance of Slag and of Lime in ensuring an Early Start of Young Seeds.—An interesting experiment at Rothamsted, commenced for another purpose, has incidentally afforded an admirable illustration of the value of basic slag and lime in stimulating growth of clover where sown in a corn crop (in this instance barley), and thereby ensuring a satisfactory plant. In the control experiments the young clover made the usual start, but on the plots receiving slag and lime the plant was much

better and made approximately twice as much growth *without in any way interfering with the barley*. The slag was applied in the spring. Frequent complaints are received at Rothamsted of the failure of young seeds; many causes no doubt operate, but shortage of lime and phosphate is probably a frequent source of trouble. In such cases application of lime and slag offers a method of dealing with the problem which is both simple and effective.

Spring Dressings of Nitrogenous Fertilisers on Oats.—In last month's Notes it was shown that spring dressings of nitrogenous fertilisers benefit the wheat crop; other experiments show that such dressings are of great advantage to the oat crop also. For example, in 1919 the following results were obtained at Rothamsted. The grain yielded in bushels per acre was:—

Top dressing.	Expt. A.	Expt. B.
None	64	49
Sulphate of ammonia	80	63
Nitrate of soda	72	69

while the yield of straw in cwt. per acre was:—

Top dressing.	Expt. A.	Expt. B.
None	30½	25½
Sulphate of ammonia	40½	34
Nitrate of soda	41½	38

The gain from the use of the sulphate of ammonia or the nitrate of soda is very evident both in grain and in straw.

Nitrolim as Fertiliser.—Enquiries are being made as to the proper use of nitrolim. When applied to arable land it should be put in with the seed and *not used as a top dressing*. During the War some attempts were made on the Continent to obtain satisfactory results from top dressings of nitrolim, but they were not successful. Similarly in this country a few trials have been made of the effect of nitrolim in top dressings, but nothing useful was obtained. In one case a mixture to be cut for green food was used as the test crop. Some of the results from equal areas were:—

No nitrolim	66½ cwt.
Nitrolim as top dressing	66½ "
Nitrate of soda	70½ "

On grass cut for hay, increased crops have been obtained so long as the material is applied sufficiently early; thus at Rothamsted the yields were:—

No nitrolim	27 cwt. hay per acre.
Nitrolim	32 " "

Elsewhere, in another experiment *where it was applied late*, no increase was obtained. No fertiliser can be expected to act unless it is properly used, and all experience shows that the proper use of nitrolim is to work it early into the soil and not use too late.

FEEDING STUFFS IN MARCH.

E. T. HALNAN, M.A.,

Ministry of Agriculture and Fisheries.

WHEN purchasing a feeding stuff two items generally are considered by the prospective buyer, namely, the food value and the residual manurial value. For this reason the buyer requires a guide which includes both values, and these will be found in the table on p. 1155.

The method adopted of valuing feeding stuffs is as follows:—

The price of the feeding stuff is obtained* (col. 2); the manurial value is then ascertained (col. 3), and is based on the residual manurial value of the nitrogen, phosphoric acid and potash present in the feeding stuff. This value remains constant so long as the unit value of manures remains approximately constant; there is no necessity to take notice of minor fluctuations. The food value (col. 4) is arrived at by deducting the manurial value from the purchase price, and by dividing the food value by the starch equivalent (col. 5), the price per unit of the starch equivalent (col. 6) is obtained.

The unit of starch equivalent represents the food value of one-hundredth part of a ton, and divided by 22.4 will give the price per lb. of starch equivalent (col. 7). This column is a useful guide in assessing the relative values of all feeding stuffs given in the table.

Comparison of present prices with those published in last month's *Journal* shows a further reduction, and groundnut cake, palm kernel cake and decorticated cotton cake now appear to be comparatively cheap feeding stuffs. In view of the coming spring a purchase of common cotton cake is recommended, as the use of this cake will be found desirable to alleviate scour in cattle turned out to grass.

Several readers lately have written as to the value of different varieties of maize and its by-products for feeding purposes. At the present time there are two types on the market (either whole or as a meal), known as round and flat maize; the flat type has a feeding value about 1 per cent. higher than the round. Yellow and white varieties of maize of the same type have the same feeding value. In America the flat varieties are known as "dent corn" and the round as "flint corn"; the former, however, are almost exclusively used for feeding stock.

* The prices quoted in the table are ex mill or store, and do not include transport charges and dealers' commission, which vary in different districts. Readers are advised to calculate the values in accordance with the note at the end of the table. The prices were those current at the end of January.

NAME.	Price per Qt.		Price per Ton.		Manurial Value per Ton.		Food Value per Ton.		Starch Equiv. per 100 lb.		Price per Unit. Starch Equiv.		Price per lb. Starch Equiv.	
	s.	lb.	£	s.	£	s.	£	s.	£	s.	s.	d.	s.	d.
Barley, English Feeding	51/9	400	14	10	1	6	13	4	71	3/9	2/01			
" Foreign	52/6	400	14	14	1	6	13	8	71	3/9	2/01			
Oats, English	45/6	336	15	3	1	9	13	14	59.5	4/7	2/45			
" Foreign	34/2	320	11	19	1	9	10	10	59.5	3/6	1/87			
Maize	55/-	480	12	17	1	5	11	12	81	2/10	1/52			
Beans, English spring	—	—	—	—	—	—	—	—	—	—	—	—	—	—
" winter	70/-	332	14	15	3	1	11	11	66	3/6	1/87			
" Chinese	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Peas, English blue	68/-	504	15	2	2	13	12	9	69	3/7	1/92			
" dun	78/-	504	17	7	2	13	14	14	69	4/3	2/28			
" maple	78/-	504	17	7	2	13	14	14	69	4/3	2/28			
" Japanese*	130/-	504	28	18	2	13	26	5	69	7/7	4/06			
Buckwheat	74/-	392	21	3	1	9	19	14	53	7/5	4/06			
Rye, English*	68/6	480	16	0	1	8	14	12	72	4/1	2/19			
Millers' offals—Bran	—	—	13	10	2	10	11	0	45	4/11	2/63			
" Coarse middlings	—	—	14	10	2	10	12	0	64	3/9	2/01			
Barley meal -	—	—	20	0	1	6	18	14	71	5/3	2/81			
Maize " -	—	—	13	10	1	5	12	5	81	3/-	1/61			
Bean " -	—	—	19	0	3	1	15	19	66	4/10	2/59			
Fish " -	—	—	22	0	7	12	14	8	53	5/5	2/60			
Linseed " -	—	—	17	0	2	16	11	4	119	2/5	1/29			
Cakes, Linseed	—	—	17	0	3	12	13	8	74	3/7	1/92			
" Soya -	—	—	—	—	—	—	—	—	—	—	—	—	—	—
" Cotton seed	—	—	10	0	3	5	6	15	42	3/2	1/70			
" Cotton seed decorticated*	—	—	19	0	5	6	13	11	71	3/10	2/05			
" " decorticated meal	—	—	16	0	5	6	10	14	71	3/-	1/61			
Coconut cake	—	—	10	5	3	0	7	5	79	1/10	0/98			
Groundnut cake	—	—	16	0	3	9	12	11	57	4/5	2/37			
" decorticated*	—	—	16	0	5	5	10	15	73	2/11	1/56			
Palm kernel cake*	—	—	7	10	2	1	5	9	75	1/5	0/76			
" " meal	—	—	7	0	2	1	4	19	75	1/4	0/71			
Brewers' grains, dry	—	—	8	5	2	7	5	18	49	2/5	1/29			
" " wet	—	—	1	15	0	12	1	3	15	1/6	0/80			
Distillers' " dry	—	—	11	10	2	16	8	14	57	3/1	1/65			
" " wet	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Malt culms	—	—	7	10	3	6	4	4	43	1/11	1/03			
Potatoes	—	—	2	19	0	8	2	11	18	2/10	1/52			
Sweedes	—	—	1	5	0	5	1	0	7	2/10	1/52			
Mangold	—	—	1	3	0	6	0	17	6	2/10	1/52			
Vetch and oat silage	—	—	2	15	0	15	2	0	14	2/10	1/52			

* Prices at Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in the larger markets, usually London, and refer to the price ex mill or store. They are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose palm kernel cake is offered locally at £10 per ton. Its manurial value is £2 1s. per ton. The food value per ton is therefore £7 19s. per ton. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 1d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.11d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market.

One class of meal is obtained by grinding the whole maize, but the other has the embryo and hull removed during the process of grinding. As the embryo contains a large proportion of oil present in the grain, the whole meal is preferable; consequently, in his own interest, the buyer should ascertain what class of meal he is purchasing before concluding the bargain. In future the writer will deal each month with one of the more important feeding stuffs and its by-products, priority being given to those on which correspondents have expressed a wish for information.

It is possible this year that breeders of live stock, particularly milk producers, will be able to rear a number of their better class calves with a view to retaining them in the herd. In doing this they will sacrifice an immediate profit which they would have obtained by selling the whole milk consumed by the calves, but the profit will be realised eventually in the value of the cow or store produced. Some useful information on calf rearing, with due regard to the necessity for economy in the use of whole milk, is given in Leaflet No. 142.

Occasionally a raw egg beaten up in the calf mixture given during the early weeks of the calf's life is a valuable addition. Eggs are rich in all the vitamins considered essential for the young growing animals, and their use occasionally is strongly recommended on this account.

NOTES ON POULTRY KEEPING.

Fall in Prices of Eggs and of Feeding Stuff.—Poultry keepers may gather some consolation for the recent rapid fall in the price of eggs from the fact that the wholesale prices of feeding stuffs have also fallen considerably during recent weeks on the London market (see table).

			<i>Price, week ended</i>	
			<i>3rd Nov., 1920.</i>	<i>16th Feb., 1921.</i>
	<i>per</i>		£ s.	£ s.
Wheat (British Feeding) ...	504 lb.		4 11	3 5
Barley " " ...	400 lb.		4 5	1 16
Oats (English) ...	336 lb.		2 19	2 1
Fish Meal ...	ton		25 0	22 0
Barley Meal ...	"		25 0	17 15
Maize Meal ...	"		19 0	12 17
Coarse Middlings (British) ...	"		15 10	12 10
Bran (British) ...	"		14 10	11 10
Fine Middlings (Imported) ...	"		20 10	14 10
Pollards (Imported) ...	"		15 15	11 0

NOTE.—The prices of meals and offals given above are not for less than 2 ton lots ex-mill or store.

The average fall in price for all the feeding stuffs shown is approximately 29 per cent. from the beginning of November to the middle of February. Barley meal and maize meal have fallen £7 5s. and £6 3s. per ton, or 29 and 33 per cent., respectively, whilst the price of fine imported middlings has fallen nearly 80 per cent., and English oats and pollards also show a fall of about 80 per cent. With the exception of English barley, which is usually only used to any extent for poultry feeding by the general farmer, all these feeding stuffs figure largely in the poultry keeper's feeding stuffs bill.

On the other hand the average price of best British eggs has fallen from 8s. 2½d. per dozen for the week ending 3rd November, 1920, to 3s. 10½d. per dozen for the week ending 16th February, 1921, a reduction of 1s. 8½d. per dozen or 33 per cent. The price of eggs usually falls at this season of the year, but the fall this year has been much greater than in the corresponding period of 1919-20. The average price for the week ending 5th November, 1919, was 5s. 0½d. per dozen, and for the week ending 18th February, 1920, 3s. 10½d. per dozen, a reduction of 1s. 2d. per dozen or 23 per cent.

It is estimated by leading poultry farmers that the cost of feeding stuffs constitutes about 60 per cent. of the total charges

against production. It is desirable, therefore, that all possible economy should be practised in this direction with the object of cheapening production. The possibilities of obtaining high egg production by using feeding stuffs of an inferior quality were explored to some extent during the War, and although the results obtained in some cases were surprisingly good, further experiment is required in this direction before definite recommendations can be made. The inferior feeding stuffs used during the War period have now fallen out of favour and are replaced generally by good meal and grain. Even palm kernel meal which was used to a considerable extent has not gained in popularity, though it is a distinctly useful food for poultry if used in moderate proportions, namely, 10 to 15 per cent. It is also comparatively cheap. The tendency at one time to a freer use of clover meal has apparently ceased. The rise in the price of this material was not accompanied by an increase in quality, but rather the reverse. Where clover meal of good quality and reasonable price can be obtained, however, its value as a food for laying hens deserves close attention. Fortunately fish meal has improved in quality and the present price makes it a cheap form of animal food for poultry. Substitutes, such as bracken root meal, dried tomato skins, seaweed meal, &c., which were tried during the War, are now receiving little attention. The cost of such substitutes and the results obtainable from them require to be carefully investigated before any recommendation could be made regarding their use.

The specialist egg farmer is the producer most likely to feel the effect of the fall in egg prices, because he has to purchase practically the whole of the food requirements for his birds, whilst the general farmer, whose birds are able to find more of their food from foraging over the land, is in a more favourable position in this respect. The specialist producer, however, not only secures usually a larger proportion of eggs in the winter months when prices are high, but also as a rule adopts more productive methods of feeding. The bulk of the eggs produced in this country are probably produced on ordinary agricultural holdings, but considerably increased production from farm poultry could be obtained, particularly in the winter months, if farmers were to adopt more efficient methods of feeding. The aim should be so to supplement the food obtained by the birds in foraging that they may receive a sufficient and properly balanced ration. Many farmers buy no special food for their poultry, which are fed entirely on the products of the farm. Up

to a point this is a sound principle, but it frequently results in indifferent egg production. Laying poultry require some form of animal food, especially during the winter months, and happily the use of fish meal for pig feeding and calf rearing is in some cases now extended to farm poultry. Fish meal is one of the most valuable foods for egg production, and should be regularly used in the proportion of 10 to 15 per cent. by weight of the total food given to the birds.

Maize is an excellent grain for poultry and might well be even more widely used than it is at present. It appears, however, to suit poultry better when cracked than when given whole.

Chicken Rearing.—The cost of rearing is usually a heavy item for poultry keepers who are unable to provide their chickens with ample fresh ground. During the rearing season there is an abundance of natural food on suitable land provided it is not too heavily stocked. The poultry keeper would frequently find it cheaper to increase the area of land for rearing than to overstock the land available. The extra rent paid would be counterbalanced by the saving in food, and at the same time the chickens would thrive better. There is a heavy annual depreciation in the value of a laying bird as the cost of rearing is in any case high, and this depreciation should be reduced as far as possible in view of a further possible fall in egg prices.

There is a considerable tendency to use unsuitable and unnecessarily expensive ingredients in the feeding of chickens, and this is particularly noticeable in the case of certain dry chick foods. Variety in feeding is a distinct advantage, but this may be secured at the expense of economy. Three of the most valuable ingredients for dry chick food are probably cracked wheat, cracked maize and groats or coarse oatmeal. Animal food such as meat meal or fish meal is not really essential for chickens for the first fortnight of their lives. Millet is frequently used to a large extent in proprietary mixtures, but is not usually eaten readily by the chickens. Rice, if used at all, is better given in a cooked form, especially when the chicks suffer from diarrhoea. The following simple mixture is an example of a dry chick food which is comparatively inexpensive and easy to make up, and which will be found quite satisfactory in practice:—

3	parts by weight	Cracked Wheat.
1	" "	Cracked Maize.
1	" "	Groats or Coarse Oatmeal.

4 or 5 per cent. of linseed, which will assist the chicks in feathering, or a similar quantity of hempseed may be included

in cold weather. If the litter in the brooder is kept clean a small quantity of this mixture may be scattered on the floor once or twice daily, and this will keep the birds actively employed when they have to take shelter from bad weather.

Various methods of feeding chickens are adopted by poultry keepers with equal success, and there is little justification for stating that any one system is the best. Probably the system which includes the use of dry chick feed, a dry mash, and a wet mash is as good as any. A suitable dry mash may be made up as follows:—

- 2 lb. Bran.
- 2 lb. Middlings.
- 1 lb. Sussex Ground Oats.
- 1 lb. Maize Meal.
- $\frac{1}{2}$ lb. Fish Meal.

To this mixture some poultry keepers add 4 per cent. of fine charcoal. Good wet mashes may be made up of:—

- 1. Boiled Rice and Middlings in equal parts by weight,
- 2. Biscuit Meal " " "
- 3. Middlings 2 parts, Sussex Ground Oats 1 part, Maize Meal 1 part,

with the addition of 10 per cent. of meat or fish meal after the chicks are a fortnight old. The wet mash should be made up with boiling water and given in a crumbly condition.

The dry mash should be fed in a shallow hopper which can be opened or shut by the poultry keeper according to the periods when he desires the chickens to take this food.

A simple system of feeding is to give the birds a meal of the wet mash as early in the morning as practicable. About 10 o'clock a little dry chick feed may be scattered amongst the bedding. At mid-day the dry mash hopper may be opened for the remainder of the day and in the mid-afternoon a little more dry feed may be scattered in the bedding. If desired a further feed of wet mash may be given for the last meal at night, but this is not necessary. Very young chicks require to be fed at frequent intervals, the object being to keep the birds active, bright and thriving. As they grow older the number of meals should be reduced, but the poultry keeper should bear in mind that the less the chicks are kept under hot-house conditions the better, and that provided they have access to a warm dry brooder whenever they require it, the more they are encouraged to take exercise in the open air, even in the early season, the better they will thrive.

AGRICULTURE ABROAD.

KEEPING FARM ACCOUNTS—FIRING OF HAYSTACKS.

IN every course of agricultural education the question of accounting arises, whether large-scale or small-scale farming is undertaken. The United States Department of Agriculture has recently issued an interesting pamphlet* dealing with this matter, in which is outlined a method of analysing the farm business with a view to determining the investment, expenses and profits. It is pointed out that farming accounts may be grouped into two classes: (1) those pertaining to the farm business as a whole, or financial accounts, and (2) those relating to an analysis of the various enterprises, commonly called detailed cost accounts.

The aim of the publication is to show the farmer how he may arrive at an analysis of his business as a whole. This analysis is based on preliminary accounts tabulating labour and other records of all items, as well as the records of costs incurred in feeding live stock. The entire system is finally brought down to a table called the Farm Summary, which groups totals of the detailed accounts under the heads of Investment, Farm Receipts, Farm Expenses, Farm Income, Interest on Investment, Labour Income, Value of Operator's Labour, Percentage Return on Investment, and Value of Items for Family Use. The first three headings are again sub-divided into three, viz., *Investment*, comprising Real Estate, Live Stock, Machinery and Equipment, Food and Supplies and Cash to Run the Farm; (2) *Farm Receipts*, comprising Live Stock Increase, Other Sources, and Increase in Food and Supplies; (3) *Farm Expenses*, comprising Current Costs, Unpaid Family Labour, Decrease in Live Stock, Depreciation and Decrease in Food and Supplies.

To arrive at the investment result, the average of the investment at the beginning and at the end of the farm year may be taken, or merely the investment at the beginning of the year, whichever more nearly represents the true capital invested in the year's business. The choice is governed by

* Farmers' Bull. No. 1139, "A method of analysing the Farm Business."

conditions on individual farms. If real estate improvements are made, additional equipment purchased or additional live stock added early in the year and used in the year's business, the average of the investment at the beginning and end of the farm year should be used. Should such changes in investment have occurred late in the year, the amount at the beginning of the year will probably represent more nearly the capital from that year's business. The total under the five subordinate heads already mentioned will give the entire farm investment on which interest should be charged.

Under *Receipts* the sum of the four subordinate groups will represent the total receipts of the farm, and in like manner, the items which fall under the general heading of *Expenses* will show the position for total outgoings. Farm Income is arrived at by subtracting the total expenses from the total receipts, the result giving the total money receipt for the use of capital and workmen's wages. In calculating Labour Income, it must be remembered that capital has an earning power which at least equals the current rate of interest on well-secured farm loans. Interest at this rate deducted from the farm income gives the farmer's labour income. This last represents the amount of money remaining to the farmer after paying all business expenses and deducting interest on the money invested in the business. In addition to the labour income, the farmer has the use of the farmhouse and products such as fruit, garden vegetables, dairy produce and fuel, that are furnished by his land towards his living. The difference between receipts and expenses will not necessarily correspond to the money in hand or in the bank, as personal and living expenses have to be paid out of this amount. A further deduction will be interest on mortgage or other debts, together with any principal paid.

The object of this record is to ascertain how much the farmer makes, not how much he actually saves. After the farm return is known, the responsibility rests with the farmer himself as to how much he will spend personally or use in other ways. There must be a proper relation between all the different classes of work carried on, and account keeping will enable farmers to ascertain at once and with accuracy which of their undertakings are successful, and which unsuccessful.

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AN interesting article on the firing of haystacks, by G. Laupper, of Zurich, appears in the Swiss Agricultural Yearbook for 1920. After a short historical

**The Firing
of Haystacks.**

discussion the author gives a very exhaustive account of all the papers bearing on the subject, and concludes his article with a useful bibliography. In the light of the newer facts elucidated as a result of recent research, the following account may be given as to the probable causes of the firing of haystacks:—

Four Phases in the Heating of Haystacks.—In the heating of haystacks four successive phases may be distinguished. In Phase 1, the hay sweats, and a temperature of 50°C. (122°F.) is reached, generally within two days. The hay then passes into Phase 2. Sweating increases, much vapour is given off, together with an aromatic smell, and the hay becomes a light brown colour. A temperature of 70°C. (158°F.) is reached, usually in about a week.

Phases 1 and 2 are considered desirable in the making of hay. The heating in Phase 1 is due to the respiratory activity of the plant cells; the heating in Phase 2 is variously attributed by authors to bacterial action, ferment activity, and the catalytic action of combinations of iron and manganese. The exact cause of this heating is not yet clear, and further research on the subject appears to be necessary, especially in view of the importance of controlling this phase in order to prevent the onset of Phases 3 and 4.

In Phase 3 the temperature increases to 90°C. (194°F.), a dark brown hay is produced, and much vapour is given off, together with a pungent smell. The causes which lead to rise of temperature in this and the succeeding phase are entirely chemical in origin. A fortnight to three weeks may elapse from the beginning to the end of Phase 3.

Phase 4 culminates in combustion, and is a very dangerous period. The temperature from 90°C. (194°F.) to ignition point may be reached within two hours. The phase consists of a damp distillation followed by dry distillation. Gases are given off, a pungent and slightly burning smell may be detected and the hay rapidly carbonises. Hay which has reached this phase without eventually firing has a black-brown or black colour, and has lost most of its nutritive value.

It has also been shown that heating in the stack is most liable to occur with young grasses containing a large proportion of water-soluble material. In other words, the most

nutritive grasses and clovers require most care in conversion into hay. In heating, too, the losses fall on the water-soluble material, i.e., that part of the hay of best feeding value.

Points to be noted in Making and Stacking Hay.—The practical points of most interest to the farmer arising out of the results of these researches are:—

- (1) In making hay, the better the quality of the forage dealt with the more care is necessary in curing the hay and building the stack in order to avoid undue heating.
 - (2) The heating of a stack is not due entirely to the presence of moisture. As is shown above, the amount of water-soluble material present plays a very important part. Of two stacks built under similar conditions, one of poor grass and one of good quality grass, the good quality stack may easily overheat, whereas the poor grass stack may not, although the same amount of moisture may be present in both. It also follows that rain-washed hay, when made up into a stack, rarely overheats, even when got under unfavourable conditions.
 - (3) In hay making, the chief aim of the farmer should be to cure the hay at the lowest possible temperature. High temperatures in the stacks mean considerable loss of nutritive value in the resulting hay.
 - (4) The temperature of the stack will give a very useful indication of the possibility of overheating, and will also help to indicate the necessity of taking precautionary measures. A temperature of 70°C. (158°F.) is the warning point, and a temperature of 90°C. (194°F.) marks the critical point; immediate precautionary measures are indicated when the stack heats to this extent. A temperature of 110°C. (230°F.) indicates the explosive point; opening the stack at this stage will probably lead to immediate firing.
 - (5) Inefficient methods of ventilation of the stack are worse than useless. The main aim in stack building and in preventing overheating should be consolidation not ventilation in cases where the hay is got in good condition.
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A SCHEME of co-operative farming by small holders is in operation in a Midland county, and it is interesting to learn

**Co-operative
Farming on
Small Holdings.**

that the experiment so far has met with conspicuous success. The County Council purchased a farm in 1919 for the settlement of ex-Service men. Instead, however, of dividing the whole area into small holdings, the Council let one large holding jointly to four applicants. This holding comprises 182 acres of land, half of which is arable and half pasture, a farmhouse used as a residence by two of the partners, a cottage occupied by another partner, and outbuildings. A rent of £2 per acre is paid.

The tenancy is held by the four partners, one of whom is accepted by the others as leader owing to his knowledge of agricultural work. Capital has been subscribed by each of the men, the leader having placed £1,000 in the fund. Each partner draws a weekly wage, and at the end of the working year part of the profits is divided between them pro rata to the share each has contributed; the balance is used as a reserve fund.

The holding is managed on strictly business lines. The work is distributed between the partners, two working as horsemen and one as stockman, while the leader assists in the milking, keeps the accounts and acts as general foreman. Hired labour is employed occasionally.

The live stock consists of 54 head of cattle, including 14 milch cows and a bull, 6 horses and several pigs of good type. There is also a flock of sheep, which at the end of November last was being folded on swedes. It was then proposed to winter 48 sheep and fatten 112 for sale.

About 20 gallons of milk were being sold wholesale daily in the town a few miles from the farm. This provided a weekly income of about £19, which the partners find very convenient for meeting current expenses. The stock and potato crops have realised good prices.

The success of this co-operative undertaking is due largely to the enterprise and industry of the small holders, to whom all credit is due for the thoroughness with which their work is done.

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Among the Training Centres that have done much to improve not only the prospects but the health of ex-Service men, the

**Ex-Service Men
and Rural Life:
Training at
Telscombe.**

one at Telscombe, near Newhaven, in Sussex, managed by the East Sussex Agricultural Committee for the Ministry, deserves mention. Work there is not yet a year old, but there are nearly ninety men receiving instruction—among them a certain number who suffered badly from shell-shock or lost limbs in the War. The work is varied. Poultry-keeping is the main source of the activities, trap-nesting and egg-recording being practised, but horticultural instruction is carried on extensively, while pigs and rabbits are also kept.

An experiment is being conducted at the Telscombe Centre to ascertain the relative values for table purposes of certain pure breeds and first cross. The varieties under test are:—*Pure Breeds*: White Wyandotte, Rhode Island Red, Light Sussex, and Brown Sussex; *First Crosses*: Coucou de Malines—Light Sussex, Indian Game—Light Sussex, Faverolles—Light Sussex, and Barred Plymouth Rock—Light Sussex.

The chickens reared from these breeding pens will be weighed at different stages, and their relative rates of growth noted. A test will also be made of the comparative commercial results obtainable from the various methods of fattening, *i.e.*, cramming, trough feeding and open pen feeding.

The rabbits kept at Telscombe are those having pelts of special value. Blue Beverens and Havanas are the favourites, and some are kept in the runs with the chickens—a method that enables them to get more exercise than they could hope to obtain in a hutch.

The trainees live in army huts during the week, but some come from Brighton, only a few miles away, and go home from Saturday to Sunday night. The skill of one trainee who, having lost an arm yet contrives by means of special appliances to kill, pluck, dress and truss chickens in record time and literally single-handed, has already attracted widespread attention.

On the horticultural side the teaching deals with garden soils, draining, trenching, digging, ploughing, manuring, enclosing, the treatment of bush fruit and fruit trees, planting and transplanting, insect and fungoid pests, and the cultivation of all vegetables. Favourable weather is devoted to work on the land, and during the worst of the year, when the land is unapproachable, lectures are given, or manual work is done in the shops.

It should be noted that in furtherance of the policy of practical teaching and the preparation of the trainees for the actualities of life after leaving the Centre, many appliances used at the Centre are hand-made. The trainees make their own poultry houses and appliances of various description, and when they have completed appliances for which there is no immediate use at the Centre they find invariably that there is a ready market for them outside. The duration of the course of training is one year. It might be mentioned that the very thriving pigs kept at the Station are fed entirely on kitchen waste and small potatoes; and they are yielding first-class pork to the trainees at a cost that would make the average housewife very envious.

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THE abnormal conditions of labour and marketing during the war have had unfortunate results upon many crops in this country, but it seems likely that none has suffered as great a measure of deterioration as the English field pea.

Field Rogueing of English Peas.

Prior to the War it enjoyed a greater reputation and commanded a higher price than any other variety. At the present time, however, the position is reversed; large quantities of Tasmanian, Japanese and Dutch peas are being imported and find a ready sale owing to their superior appearance, while the English stocks have become badly mixed, not only with purple-flowered varieties but with several types of green pea.

There is a three-fold reason for this deterioration. *Firstly*, the scarcity of labour for the land resulted in defective cultivation; *secondly*, the shortage of food-supply made it possible to find a ready market even for inferior qualities; and *thirdly*, the practice adopted by too many farmers of sowing their own home-saved, and degenerated stock for two or three seasons in succession.

The labour shortage has now lessened; purchasers are refusing to buy inferior goods at high prices, and there are still good supplies of properly "rogued" seed in the country. The remedy is in the hands of the farmer and contractor, and it is for them to say whether this branch of agriculture shall regain its old position of ascendancy, or be ultimately driven from the field by its foreign rivals.

Special knowledge and experience are necessary for seed-raising. The inexperienced grower would probably be best advised to grow on contract, and follow closely the instructions of the expert. The present position of the industry gives yet

another illustration of the truth that the use of home-saved seed is so frequently bad economy. It was noticeable in last season's crop, that a large percentage came out "round," neither green field peas such as the flat-sided semi-wrinkled "Harrison's Glory" nor indented Marrowfats, and that this was at its worst when the crop was from home-saved seed.

Two things must be done if the position is to be restored. *Firstly*, in the purchase of seed it will prove to be money well invested to sow the best quality procurable; *secondly*, the absolute necessity for field-rogueing must be realised, for if this is neglected, no degree of care and skill will avail to obtain the desired standard of improvement.

To facilitate proper cultivation and rogueing, peas should be grown in rows not less than 12 inches apart. In this way no permanent injury will be done to the crop in rogueing, and the value of the harvest will be greatly enhanced.

Purple-flowered hybrids can be eliminated easily by "rogueing"—so far at least as our present knowledge goes—and since the axils of these are so coloured that they catch the eye, the crop can be "rogued" for the first time as soon as the plants are about eight leaves high, and any that escape at this time can be "rogued" again on the blossom. If the farmer will take the trouble to have these precautions carried out, and where growing on contract gives free access to the expert "roguer," there seems no reason why English peas should not recapture their former position of pre-eminence within the course of the next two years.

Unfortunately many stocks contain numbers of white-flowering types differing in pod-shape, length of haulm, shape, size, colour of seed, &c.; in such cases field-rogueing becomes a matter of extreme difficulty. The only real remedy for establishing re-selected true stocks, is for the growers to pick out a few perfectly typical plants of the desired varieties, or better still, to raise and work up a stock from a single perfect plant.

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THE importance of re-stocking eel ponds and rivers annually is probably insufficiently realised by the owners of such waters.

**The Ministry's
Scheme of Elver
(Eel Fry)
Distribution.**

It may not be generally known that the common or "freshwater" eel does not breed in the rivers and streams in which the greater part of its development takes place. Unlike the salmon, which returns from the ocean in the spring to breed in the river, the eel, when

ready to breed, travels in the autumn in the reverse direction, from river to ocean. Recent discoveries have shown that with the object of breeding the eel undertakes an immensely long journey, the probable breeding place of all the European eels being far out in the Atlantic. When about to depart, the eel changes its colour from yellow to silver, resembling in this respect, and in its large eyes, the fish that inhabit the ocean at a depth of from 50 to 300 fathoms. The breeding eels never return, but the larvæ are carried eastwards and north-eastwards by the North Atlantic drift, and after a long time, probably about two years, become elvers (eel fry). In the spring the elvers make their way to the fresh water, where, after feeding and growing for from 3 to 12 years they become mature "silver" eels.

It has long been known that eels descend to the sea in the autumn and that elvers ascend the rivers in the spring, but it had been assumed until comparatively recently that the elvers were the offspring of the eels which had descended the previous autumn. It was not until 1904 that any definite knowledge was gained of the breeding habits of the eel, and the exact breeding grounds have only just been discovered by the eminent Danish naturalist, Dr. Johannes Schmidt. Dr. Schmidt has proved that the European eel is not split up into local races, but that only one species exists, and this is found on the coasts and in the rivers of all countries that border the Eastern North Atlantic, from Iceland and Scandinavia to Morocco and Madeira and throughout the Mediterranean. It lives under a variety of conditions, in hot and cold climates, in the sea and in fresh water, in rivers, lakes, brooks and ponds.

The distribution of the larval eels from the Atlantic breeding ground is determined by the set of the prevalent marine currents. This explains why elvers are most abundant in countries that lie nearest to the Atlantic. Since the stock of each river is thus replenished from a common source, the limitation of the capture of silver eels in any one river is not likely permanently to affect the stock in that river. It follows that the effective method of keeping up or increasing the supply of eels in a healthy river is each season to transport elvers to the river from waters where they are more abundant.

In view of the discoveries with regard to the breeding habits of eels the German Fisheries Union established in pre-War days a depot at Epney-on-Severn for the supply of elvers to Germany, whence some of the grown eels were subsequently

re-imported into this country for consumption. During the War the Ministry took over this depot from the Public Trustee, and has since distributed elvers among suitable British waters by selling them at low fixed prices, with the object of encouraging the growth of eels for the market and thus increasing our home-grown food supply. The elvers may be taken from the Severn from the end of February onwards, and the earlier they are transported the better they are likely to stand the journey to other waters. Full particulars of the distribution may be obtained on application to the Fisheries Secretary, Ministry of Agriculture and Fisheries, 43, Parliament Street, London, S.W.1.

Orders will not be accepted after April 1st.

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THE Ministry has revoked, as from the 1st December last, the Orders requiring the compulsory general dipping of sheep in

**Regulations as
to Dipping of
Sheep.**

this country involving a single dipping or (in Scotland and the North of England) two dippings at long intervals. The Ministry recognises, however, that Local Authorities and sheep owners in various parts of the country may wish to continue the general compulsory dipping of sheep in their districts as a safeguard against the risk of the introduction of the disease to their flocks, and powers have accordingly been given enabling them to do so. The Ministry desires, however, in this connection, to emphasise the fact that in the event of any Local Authority deciding to exercise these powers, nothing short of double dipping in a dip approved by the Minister, with an interval of not less than ten and not more than fourteen days between the dippings, would, in the considered opinion of the Ministry, serve the purpose in view.

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It is desirable that the provisions of the Onion Smut Order of 1920, issued by the Ministry in May last in the interests of

**The Onion Smut
Order of 1920.**

controlling the spread of Onion Smut (*Urocystis cepulae*) in this country should be known as widely as possible. Onions and leeks, whether seedlings and sets or bulbs, come within the scope of the Order. The main provisions of the Order are as follows:—

(1) *Restrictions as regards Infected Places.*—(a) No person shall sow or cause to be sown onion seed in an infected place,

or plant or cause to be planted any onion seedling plants in an infected place unless such plants have been raised in land which is not in an infected place.

(b) Onion plants grown in an infected place shall not be removed from the infected place unless and until the plants have been inspected while growing by an Inspector of the Ministry and certified by him to be free from Onion Smut, and have been washed free from soil.

(2) *Restrictions as regards Movement of Onion Plants grown in an Infected Area.*—No person shall remove outside an Infected Area any onion plant grown in the Infected Area unless and until the plant has been inspected while growing by an Inspector of the Ministry and certified by him to be free from Onion Smut.

(3) *Dealings with Diseased Plants.*—An Inspector of the Ministry may by notice served on the owner or person in charge of plants affected with Onion Smut require the destruction by him forthwith of such plants by fire or other suitable method, and the same shall thereupon be destroyed accordingly. Onion plants visibly affected with Onion Smut shall not be sold, or offered for sale for any purpose.

(4) *Notification of the Disease.*—(a) The occupier or other person in charge of any land in an Infected Area on which Onion Smut exists or appears to exist, and any person having in his possession or under his charge onions which are affected with Onion Smut, shall forthwith notify the fact by post or otherwise to the Ministry or an Inspector of the Ministry.

(b) If Onion Smut is found to exist in any subsequent year on land in respect of which notification of disease has been given a further notification of disease shall be given.

Failure to comply with the Order renders a person liable to penalty not exceeding £10. The Order does not apply to Scotland or Ireland.

A full text of the Order (No. 720 of 1920) may be obtained from H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2, price 1d., excluding postage.

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At this season of the year the disease known as "Dry Rot" is apt to show itself in regrettable quantity in seed of first early potatoes. It is particularly severe in the variety May Queen. The disease is caused by a fungus which, entering the seed after lifting, develops extensively after the turn of the

**Dry Rot of
Potatoes.**

year and destroys the set. It is now too late to check the fungus, though the further spread of the disease should be prevented by removing and burning affected specimens. As seed of early potatoes is a valuable commodity it may not be amiss to point out how the trouble may be reduced next season.

It has been shown that careless handling and bruising are very important factors in predisposing the tubers to disease by assisting the fungus to gain entrance. Early varieties for seed purposes should be lifted in good time, handled and riddled with great care, and put into the sprouting boxes as early as possible in the autumn. Tubers which are boxed in October and "greened" early are seldom badly attacked. Extremely susceptible varieties like Ninety Fold and May Queen should never be stored in clamps or in bins. It is perhaps advisable to state that Dry Rot is a disease quite distinct from the common blight, which is often responsible for loss of seed during winter. (For further information on Dry Rot see Leaflet No. 193, and for Potato Blight Leaflet No. 23.)

Foot-and-Mouth Disease.—*Kent (Wingham District), Shrewsbury, and Droithich.* No further outbreaks having occurred in any of these districts, all restrictions imposed in connection with the outbreaks have been withdrawn.

Lincolnshire (Grimsby District).—Seven outbreaks in all have now been confirmed in the Grimsby district, the latest being on the 20th January. The district subject to restrictions has been considerably contracted, and now consists of the country lying within a radius of about five miles from Grimsby.

Lincolnshire (Ormsby District).—No outbreak has occurred in this district since that on 3rd January, and all general restrictions have now been withdrawn.

Midland Counties Group.—The position in the Midland Counties district has improved considerably, and general restrictions are now in force only in an area comprising the City of Birmingham and the parish of Sheldon, and three other small areas around the actual outbreaks. In the Birmingham district, 8 outbreaks in all occurred, the last on the 18th January; in the Stow-on-the-Wold district and Banbury districts no further developments have occurred since the issue of the February *Journal*.

Gloucestershire and Herefordshire District.—No outbreak has been confirmed in this district, since that already referred to on 12th January, and restrictions are now applicable only to one small area in the Ledbury district.

Yorkshire (East Riding).—Five outbreaks in all have been confirmed in the Halsham district, the most recent being on 11th February, at Hollym. The restrictions on movement have been considerably modified, and now apply only to an area of about five miles radius.

Rabies.—*Wiltshire, Dorset and Hampshire.*—Five fresh outbreaks have occurred in this district since the issue of the February *Journal*, four cases being confirmed at Southampton and one at Salisbury—the latter occurred on

the 8th February. The Scheduled District has now been extended so as to include the remainder of the County of Southampton, and this brings the Portsmouth district also within the Muzzling Area. An Inner Controlled Area has also been prescribed round Southampton in view of the number of cases confirmed in and near that town.

Glamorgan.—There has been no development in this district.

Berkshire.—On the 13th January last, a case of Rabies was confirmed in Basingstoke, which was within the existing Scheduled District, and also at High Wycombe, just outside the north-eastern boundary of that district. The former case did not involve an extension of the Berkshire scheduled district, but the latter rendered it necessary to add to the scheduled district an area lying within a radius of about fifteen miles of High Wycombe. A second case occurred at High Wycombe on the 22nd January, and one at Reading, in the inner area on the 4th February. The inner controlled area was reduced as from the 8th February to its original limits of 5 miles radius from Reading which were fixed on 30th September last.

London.—There have been no developments in the Metropolitan district, and all restrictions have been removed except from the inner controlled area (Acton district) and from a small portion of the borough of Woolwich, in respect of which restrictions on "movement out" have been maintained as a precautionary measure, owing to the report of a suspected case of rabies in that borough. This case necessitates inoculation experiments being made before a decision can be given. In the event of the decision being negative the restrictions in respect of this small area in Woolwich will be removed.

Trench System of Ensilage.—In the Article on "Pit, Trench and other Silos," by Mr. A. W. Oldershaw, which appeared in the February *Journal*, a statement is made that "It is not suggested that the method of making silage in pits or trenches results in material of the same high quality as that made in cylindrical tower silos, but there is no doubt that thoroughly good silage can easily be made in this way."

The writer of the Article wishes to state that he has since had an opportunity of making further investigations as to the quality of silage made according to Mr. Makens' Trench System. Some excellent samples of silage have been made this year by the above method, and Mr. Oldershaw is now quite convinced that if care is taken to make the silage exactly as described, keeping it well trampled down and afterwards carefully covered up with earth, the quality of trench silage is in no way inferior to the best samples made in cylindrical tower silos. Moreover, if the silage in the trench or pit is carefully topped up with useless material, &c., it would appear that the amount of waste on the top need not be materially greater than that which often occurs on the top of cylindrical silos. Two trench silos were constructed by Mr. Arthur Symonds, Shelland, Suffolk, during the past year—in both cases on quite heavy land. Drains were arranged to drain off the water, and it was found that there was no excessive amount of loss in the trench. It is worthy of note that, with a cylindrical tower silo, if the material is put in carelessly and without a sufficient amount of trampling round the outside, quite a considerable loss may take place owing to air gaining admission through the carelessness of those engaged in filling the silo.

The Examination of Diseased Bees.—The Ministry desires to inform bee-keepers that the examination of diseased bees is no longer conducted at the Department of Comparative Anatomy, The Museum, Oxford. Pending the appointment by the Ministry of a bacteriologist to undertake such work, Dr. J. Rennie has kindly consented to carry out examinations and to furnish reports to the bee-keepers concerned. In future, therefore, specimens, together with the name and address of the sender, should be sent to Dr. J. Rennie, Marischal College, University of Aberdeen.

Reduction in Price of Sulphate of Ammonia.—Owing to a decline in the world prices of nitrogenous Fertilisers, the makers have agreed to reduce the price of Sulphate of Ammonia for the remainder of the 1920-21 Season. The net cash prices for Sulphate of Ammonia delivered to consumer's nearest railway station or wharf in Great Britain, or in the case of deliveries to Ireland, the Channel Islands or the Isle of Man, f.o.b. British port, in quantities of not less than 4 tons, will be:—

January	1921	...	...	£23 16s. 0d. per ton.
February	"	...	...	£24 3s. 6d. "
March—May	"	...	...	£24 11s. 0d. "

The conditions of sale and scales of allowances and additional charges given in leaflet F.P.506/S.I. will remain in force, except that the trade discount to Fertiliser Mixers, Agricultural Merchants and Co-operative Societies will be increased. All orders already placed for January/May delivery will be executed at the above prices, and the increased discount will be paid on them.

As a number of Farmers, Fertiliser Mixers, Merchants and Co-operative Societies were encouraged to take early deliveries of Sulphate of Ammonia by the difference between the maximum prices for the earlier and later months of the season, as originally announced, the British Sulphate of Ammonia Federation, Ltd., has refunded certain sums on orders placed with it or with its consent for Sulphate of Ammonia delivered and paid for at the August/December prices; consequently farmers who purchased from merchants at the prices ruling in these months should apply to their merchants for a corresponding allowance to be made to them.

Notice to Stallion Owners: Licences under the Horse Breeding Act, 1918.—Owners of stallions who intend to travel their stallions during the 1921 season are reminded again that they will require Licences from the Ministry to enable them to do so, and that as the Ministry cannot undertake to issue licences at very short notice, owners of stallions who postpone the necessary application may experience considerable delay in obtaining them.

Licences which were issued for the 1920 season expired on the 31st October last, and any licence for that season not already returned should be forwarded to the Ministry forthwith. Failure to return any expired licence renders an owner liable to a fine of £5.

A Map of Wart Disease Infected Areas.—The Ministry has issued a map showing those districts in England and Wales which are now Infected Areas under the Wart Disease of Potatoes Order of 1919. This map should prove of value to all persons concerned in the distribution and movement of "seed" potatoes. A licence must be obtained from the Ministry before any "seed" potatoes, other than certified stocks of varieties approved by the Ministry as immune to Wart Disease, are introduced into these Infected Areas.

Copies of the map, together with a list of the Infected Areas, may be obtained on application to the Ministry at 10, Whitehall Place, London, S.W.1. Price 6d., post free.

Horticultural Inspection for Export: New Scale of Charges.

The Ministry desires to inform nurserymen and others interested in the export of plants or potatoes to Foreign Countries and Colonies that it has been found necessary to revise the existing scale of fees charged, whether for the work of inspection or for the issue of certificates. The revised scale will come into operation on the 1st March, 1921, except in cases where an inclusive fee has already been paid to cover the issue of certificates down to the 31st May next. The new fees will be as follows:—

For inspection of nurseries	... ..	£2 2s. per day with minimum of £2 2s.
For inspection of growing crops of potatoes (for export to Holland or elsewhere).	Minimum of £1 1s. but fee will vary with acreage inspected.	
For each certificate issued	... ..	1s.

The scale of fees for the inspection of small consignments of plants at the Ministry's Offices, including the issue of certificates, will remain as before, viz. :—

Packages not exceeding 11 lb. in weight	... ..	1s. 0d. each.
„ over 11 lb. but under 56 lb. in weight	... ..	2s. 6d. „
„ „ 56 „ „ „ 1 cwt.	... ..	5s. 0d. „

Leaflets issued by the Ministry.—Since the date of the list given on page 1084 of last month's issue of this Journal the information contained in the following leaflets has been revised and brought up to date :—

- No. 26.—Farmers and Income Tax.
- „ 31.—The Onion Fly.
- „ 56.—Apple Canker.
- „ 62.—The Pear and Cherry Sawfly.
- „ 120.—Peach Leaf-Curl.
- „ 126.—The Sheep Maggot Fly.
- „ 235.—Organisation of the Milk Supply.
- „ 239.—The Pear Leaf Blister Mite.

The following leaflets of the Ministry have been transferred to the Forestry Commission, 22, Grosvenor Gardens, London, S.W.1:—

- No. 91.—The Pine Beetle.
- „ 99.—Relationship of Woods to Domestic Water Supplies.
- „ 103.—The Pine Sawfly.
- „ 138.—Pine Weevils.
- „ 140.—The Felted Beech Coccus.
- „ 155.—Larch Canker.
- „ 183.—Sycamore Leaf Blotch.
- „ 186.—The Large Larch Sawfly.
- „ 199.—The Pine Disease.
- „ 208.—Larch Shoot Moths.

NOTICES OF BOOKS.

Forest Products—Their Manufacture and Use.—(Nelson Courtland Brown. London: Messrs. Chapman & Hall. Price 21s.) This book deals with the commercial aspect of the manufacture and use, in the United States of America, of all important forest products with the exception of lumber, and is intended as a brief treatise, preliminary to a more exhaustive work or group of books to be written at a future date. It is the work of one whose connection with the American Timber Trade Commission and Department of Commerce should render him well qualified to deal with his subject, and who has spared no pains to ensure the accuracy of his statements by obtaining the views of specialists in those branches of industry with which he deals. In consequence of the difference between conditions obtaining in the United States of America and those met with in Great Britain, both as to market requirements, labour, and the supply of raw material, it is but natural that this interesting book, written by an American, and dealing with North American conditions, should have little direct bearing upon such problems in the disposal of home-grown timber as arise in the British Isles. The volume will appeal, therefore, rather to the general reader than to the serious student of British forestry, who will be interested in it mainly in so far as it suggests future possibilities in the development of forest industries in these islands, and weighty considerations bearing upon the formulation of forest plans.

The opening chapter of the book comprises a brief resumé of the American situation as regards the consumption and supply of timber, and in calling particular attention to the wastage consequent upon the ordinary methods of lumbering serves to emphasize the importance of the conservation of timber resources, and the elimination of that waste in manufacture which is shown in the subsequent chapters of the book to be at almost all times considerable, and which, in view of the present decreasing reserves of available timber, deserves serious consideration.

The plan adopted by the author has been to allot one chapter of the book to each forest product and therein give a brief historical statement followed by a concise and remarkably complete summary of the methods adopted in its handling, manufacture and disposal, together with, in most cases, specifications of both raw material and finished product, and important and interesting statistical information, conveniently arranged in tabular form, as to the importance of the commodity, the prices both of finished product and raw material, costs and efficiency in manufacture, and a statement of the labour employed per unit of production. The latter statement, in particular, should be of value for purposes of comparison with results obtained in similar operations in this country. The amount of technical detail given in the description of the manufacture and handling of each product should suffice in all cases to give the reader a true appreciation of the main mechanical and financial considerations involved.

The chapters having the most useful information bearing upon present conditions in the British Isles, as regards utilization of existing timber and scrub-wood, or preparations for future crops are, perhaps, those on the Pulp and Paper Industry, Wood Distillation, Fuel Wood, and Slack and Tight Cooperage, whilst the remarks on the Tanning and Charcoal-Burning Industries

in America are of particular interest in view of the problems connected therewith in this country.

The book is admirably arranged and profusely illustrated with photographs, and is provided with an excellent and very complete index. The inclusion of a table of the scientific and common names for timbers dealt with, and the use in the text of the scientific names wherever confusion might arise, is a practice worthy of more frequent adoption in such works.—O. J. S.

Forest Management.—(A. S. Recknagel and John Bentley, Jr. London: Chapman & Hall Limited. First Edition 1919, Price 12s. 6d. net.) This book purports to provide the American reader with a condensed and not too technical account of the subjects comprised under the head of Forest Management.

The subject matter is treated under the following main heads:—

Forest Mensuration.

Forest Organisation (including Working Plans).

Forest Finance.

Forest Administration.

One hundred and twenty-two pages, or rather more than half the book, deal with the subject of Forest Mensuration. Forest Organisation occupies fifty-five pages, the remaining sections being more briefly dealt with.

The long section on Forest Mensuration covers much the same ground as the corresponding chapters in Vol. III of Schlich's Manual of Forestry, but in the American work much of the space is devoted to such subjects as area surveys, log rules, and timber estimations on a large scale, which are of no importance to most students in this country.

Chapters X and XI give a short but useful account of methods of determining the increment of single trees and woods. We are bound to point out, however, that on page 116 the determination of the volume of permanent sample plots by the arithmetical mean sample tree method is open to criticism on the ground that other and more accurate methods (*e.g.*, those of Hartig and Ulrich) have long been employed by the Research Stations in Europe.

The important subject of Working Plans is somewhat cursorily dealt with in Chapter XIV, but the outline provided gives an excellent idea of the information required for these plans.

British students will find Chapter XV on Forest Finance most useful as an introduction to a subject which is often found troublesome. In particular, the U.S.A. Government's detailed instructions for calculating fire damages (on pages 201 to 208) provide interesting illustrations of the practical value of compound interest formulæ in general forestry. The final chapter deals briefly with the subject of Administration. We fancy that most British foresters will be surprised by the statement on page 217 that "while the average executive unit in Europe is 6,000 acres, the average unit in the United States National Forests is no less than 1,022,200 acres." Any except the most extensive system of working must be out of the question with units of this size.

The book is well printed and provided with an Appendix containing the usual compound interest tables and other data; there is also an excellent index.

The book may be recommended to students in this country who wish to obtain a general survey of the subject of Forest Management before taking the more advanced courses given at the Universities.—W. H. G.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous.

- Wood, T. B.—The Chemistry of Crop Production (193 pp.). London : University Tutorial Press, 1920, 5s. 6d. [54(02).]
- Okey, Thomas.—The Art of Basket-Making (158 pp.) London : Pitman & Sons, 4s. [63.193.]
- Thring, Douglas T.—Mole-Draining and the Renovation of Old Pipe Drains (13 pp.). London : John Murray, 1920, 6d. [63.14.]
- Leeds University and Yorkshire Council for Agricultural Education.—No. 115 :—The Need for Lime on Ploughed-out Grass Land, J. A. Hanly (14 pp., + 8 illus.). Leeds, 1920, 6d. [63.15.]
- Michigan Agricultural Experiment Station.—Tech. Bull. 45 :—The Effect of Fertilizer Salts Treatment on the Composition of Soil Extracts (13 pp.) East Lansing, 1919. [63.113; 63.16.]
- New Jersey Agricultural Experiment Station.—Circular 54 :—Improving Acid Soils (11 pp.). New Brunswick, 1916. [63.15.]
- Purdue Agricultural Experiment Station.—Bull. 187, Vol. xviii. :—Acid Phosphate v. Raw Rock Phosphate as Fertilizer (27 pp.). La Fayette, 1916. [63.1672.]
- Geological Survey Memoirs.—Summary of Progress of the Geological Survey of Great Britain and Museum of Practical Geology, 1919 (70 pp.). London : H.M. Stationery Office, 1920, 2s. 6d. net. [55; 912.]
- New York Agricultural Experiment Station.—Bull. 466 :—Spraying Lawns with Iron Sulphate to eradicate Dandelions. (59 pp.). Geneva, N.Y., 1919. [63.259(04).]
- Wisconsin Agricultural Experiment Station.—Bull. 309 :—Marsh Soils. (32 pp.). 1919. [63.142.]
- Robertson, G. S.—A Comparison of the Effect of various types of Open Hearth Basic Slags on Grass Land. (11 pp.). (Reprint from Transactions of the Faraday Society, vol. xvi., 1920.) [63.1672; 63.33-16.]
- U.S. Department of Agriculture.—Farmers' Bull. 1093 :—Influence of the Tractor on the use of Horses. (26 pp.). Washington, 1920. [63.175.]
- Kersey, H. W.—Farm Book-Keeping : A Simple Method. (3rd Ed.), (96 pp.). Ashford, Kent, and London : Headley Bros., 1920, 3s. 6d. [657.]

[This book is designed to meet the needs of farmers and others who require a simple system of accounts demanding a minimum expenditure of time and trouble. It is also adapted for use in agricultural and horticultural colleges and schools. Single Entry and a simplified method of Double Entry are clearly explained by the aid of a number of worked examples, while a useful appendix is devoted to the subject of farmers' Income Tax.]

- Ritchie, J.—The Influence of Man on Animal Life in Scotland : A Study in Faunal Evolution (550 pp.). Cambridge : University Press, 1920, 28s. net. [575.4; 59 (02).]

Field Crops.

- U.S. Department of Agriculture.—Farmers' Bull. 1119 :—Fall-Sown Oats (21 pp.). Washington, 1920. [63.314.]
- U.S. Department of Agriculture.—Bull. 883 :—Experiments with Flax on Breaking (29 pp.). Washington, 1920. [63.34111.]
- Nebraska Agricultural Experiment Station.—Research Bull. 13 :—Studies concerning the Elimination of Experimental Error in Comparative Crop Tests (95 pp.). Lincoln, 1918. [63.31.]
- U.S. Department of Agriculture.—Bull. 873 :—The Shrinkage of Market Hay (33 pp.). Washington, 1920. [63.1982.]
- Leeds University and Yorkshire Council for Agricultural Education.—No. 114 :—Use of Implements in the Lifting of the Potato Crop (28 pp.). Leeds, 1920. [63.17(04); 63.612(04).]

Horticulture.

- New Jersey Agricultural Experiment Station.—Circular 57 :—Asparagus (4 pp.). New Brunswick, 1916. [63.511.]
- U.S. Department of Agriculture.—Bull. 859 :—The Process of Ripening in the Tomato, considered especially from the Commercial Standpoint (33 pp.). Washington, 1920. [63.513.]

Plant Diseases.

- U.S. Department of Agriculture.*—Bull. 842 :—The Nematode Disease of Wheat caused by *Tylenchus Tritici* (40 pp.). Washington, 1920. [63.27-31.]
- U.S. Department of Agriculture.*—Bull. 893 :—Experiments on the Toxic Action of Certain Gases on Insects, Seeds and Fungi (16 pp.). Washington, 1920. [63.2945.]
- South Carolina Agricultural Experiment Station.*—Bull. 204 :—The Slender Wireworm : Its Relation to Soils (14 pp.). Clemson College, S.C., 1920. [63.27.]
- U.S. Department of Agriculture.*—Farmers' Bull. 1128 :—Control of Aphids Injurious to Orchard Fruits, Currant, Gooseberry and Grape (48 pp.). Washington, 1920. [63.27-41.]
- U.S. Department of Agriculture.*—Bull. 866 :—Pickering Sprays (47 pp.). Washington, 1920. [63.295.]
- Ohio Agricultural Experiment Station.*—Bull. 333 :—Apple Blotch : A serious Fruit Disease (14 pp.). Wooster, Ohio, 1919. [63.24-41.]
- New Jersey Agricultural Experiment Station.*—Bull. 324 :—The Strawberry Weevil (19 pp.). New Brunswick, 1918. [63.27-41.]

Live Stock.

- New South Wales Department of Agriculture.*—Farmers' Bull. 133 :—Sheep and Wool for Farmers, Part II. Cross-Breeding for Wool and Mutton (61 pp.). Sydney, 1920. [63.63.]
- Nebraska Agricultural Experiment Station.*—Bull. 170 :—Fall Lamb Feeding (28 pp.). Lincoln, 1918. [63.63.]
- Wisconsin Agricultural Experimental Station.*—Bull. 313 :—The Occurrence of Red Calves in Black Breeds of Cattle (35 pp.). Madison, 1920. [575.1.]

Veterinary Science.

- U.S. Department of Agriculture.*—Farmers' Bull. 1146 :—Dourine of Horses (12 pp.). Washington, 1920. [619.1(b).]
- Purdue Agricultural Experiment Station.*—Circular 56 :—Methods of Vaccination, Control and Eradication of Hog-Cholera (20 pp.). Lafayette, 1916. [619.4(a).]
- Texas Agricultural Experiment Station.*—Bull. 262 :—The Scaring Iron e. The Knife for Docking or Detailing Lambs (12 pp.). Texas, 1920. [63.63.]

Dairying and Food, General.

- Tanner, F. W.*—Bacteriology and Mycology of Foods (592 pp.). New York : Wiley & Sons, 1919. [576.8; 612.39.]
- Canada, Department of Trade and Commerce.*—Commercial Series No. 1.—The Dairy Industry of Canada (11 pp.). Ottawa, 1920, 5 cents. [63.7(71).]
- Michigan Agricultural Experiment Station.*—Special Bull. 99 :—The Detroit Commission Plan of City Milk Administration (30 pp.). East Lansing, 1919. [63.714.]
- Purdue Agricultural Experiment Station.*—Bull. 189, Vol. xix. :—Cream Testing Balances (20 pp.). La Fayette, 1916. [63.712.]

Birds, Poultry and Bees.

- Purdue Agricultural Experiment Station.*—Bull. 189, Vol. xviii :—Poultry Investigations : I. The Value of Meat Scrap, Fish Scrap, and Skin Milk in Rations for Laying Poultry (4 pp.). La Fayette, 1916. [63.6515.]
- U.S. Department of Agriculture.*—Farmers' Bull. 1108 :—Care of Baby Chicks (8 pp.). Washington, 1920. [63.651(04).]
- U.S. Department of Agriculture.*—Farmers' Bull. 1113 :—Poultry Houses (8 pp.). Washington, 1920. [63.6 : 695.]
- U.S. Department of Agriculture.*—Bull. 1102 :—The Crow in its relation to Agriculture (20 pp.). Washington, 1920. [59.162.]

Engineering.

- Federazione Italiana dei Consorzi Agrari.*—I Silos per Foraggi : Tipo Cremasco (16 pp., + 11 Illus.). Piacenza : Biblioteca Popolare Agraria, 1920. [694.]
- U.S. Department of Agriculture.*—Bull. 854 :—The Flow of Water in Drain Tile (50 pp.). Washington, 1920. [63.14(04).]

Economics.

- National Council of Social Service*.—Public Services, 2nd Edit. (96 pp.). London: P. S. King & Son, 1920, 2s. net. [85.]
- U.S. Department of Agriculture*.—Farmers' Bull. 1144 :—Co-operative Marketing (27 pp.). Washington, 1920. [84.6.]
- U.S. Department of Agriculture*.—Bull. 860 :—The Organization of Co-operative Grain Elevator Companies (40 pp.). Washington, 1920. [84(04).]
- Ontario Department of Agriculture*.—Bull. 279 :—Community Halls (12 pp.), 1920. [96.]

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous.

- Agricultural Climatology of Australia, *Dr. G. Taylor*. (Jour. of R. Met. Soc., Vol. xlv., No. 196.) [551.5.]
- Les Plantes Marines, *P. Gloess*. (Chimie et Industrie, Vol. 3, No. 3, 1920.) [58.2.]
- The Influence of Cold in Stimulating the Growth of Plants, *F. V. Colville*. (Jour. Agric. Res., Vol. xx., No. 2.) [58.11.]
- Influence of Moisture on Soil Bacteria, *J. E. Greaves and E. G. Carter*. (Soil Science, Vol. x., No. 5, Nov., 1920.) [63.115.]
- Aluminium as a Factor in Soil Acidity, *J. J. Mirasol*. (Soil Science, Vol. x., No. 3, Sept., 1920.) [63.113.]
- Forsøg med Kogsalt og Kalisalte, *H. R. Christensen*. (Tidskrift for Planteavl, Bind 26, Hæfte 5, 1920.) [63.167.]

Field Crops.

- A Comparative Study of Corn Silage in Concrete and Stave Silos, *R. H. Shaw and R. P. Norton*. (Jour. of Dairy Sci., Vol. 3, No. 4) [63.1985.]
- Line Selection Work with Potatoes, *O. B. Whipple*. (Jour. of Agric. Res., Vol. xix., No. 10.) [63.512.]

Horticulture.

- Investigations in the Ripening and Storing of Bartlett Pears, *J. R. Magness*. (Jour. Agric. Res., Vol. xix., No. 10.) [63.41(a).]

Live Stock.

- The Efficiency of Milk Substitutes in Calf Feeding, *G. Spitzer and R. H. Carr*. (Jour. of Dairy Sci., Vol. 3, No. 5.) [612.394.]

Dairying and Food, General.

- Arable Dairy Farming, *J. C. Brown*. (Jour. Farmers' Club, Part 7, Dec., 1920.) [63.70(04).]

Engineering.

- The Problem of Adhesion of Agricultural Tractors, *C. Julien*. (Int. Rev. of Sci. and Practice of Agric., Year x., Nos. 7-8-9.) [63.17.]

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Articles or reports on the following subjects have appeared in the *Journal* each month or from time to time, and are not separately indexed:—Notes on Feeding Stuffs, Notes on Manures, Notes on Crop Prospects and Live Stock Abroad, Notes on Agriculture Abroad, Notes on the Weather, Notes on Agricultural Labour in England and Wales, Notes on Agricultural Conditions in England and Wales, Prices of Agricultural Produce, Outbreaks under the Diseases of Animals Acts, Lists of Additions to the Ministry's Library, and Selected Contents of Periodicals.

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